Modern Refrigeration & Air Control

Vol. 62 No. 735 PLASTICS JUNE, 1959 ISSUE Price 2s. 6d. monthly

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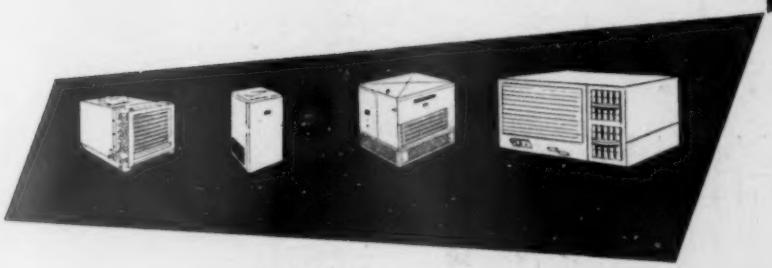

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P 2707

The photograph shows two compressors out of six in a two-stage installation serving a number of ice-cream hardening tunnels. The premises are those of Messrs. Nielsons (Ice Cream & Frozen Foods) Ltd., by whose courtesy this photograph is reproduced.

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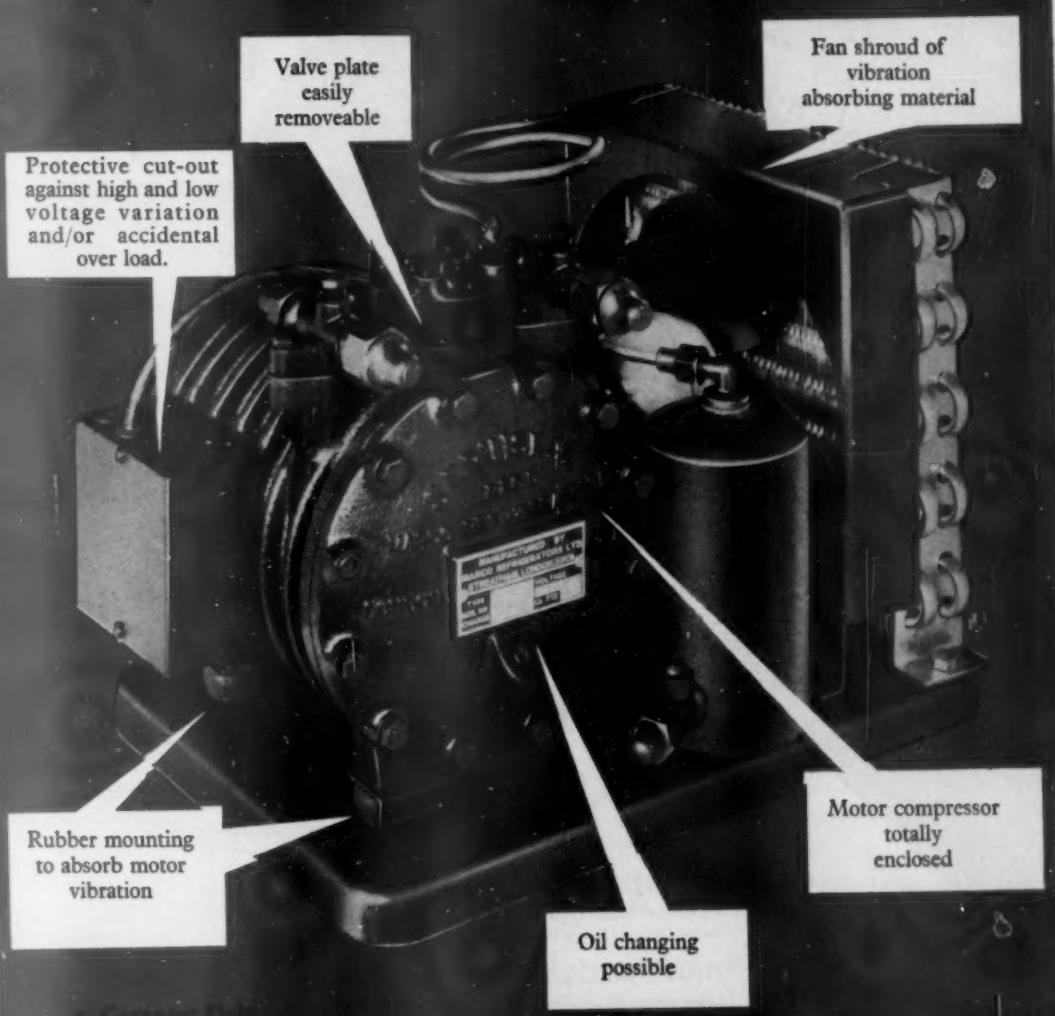
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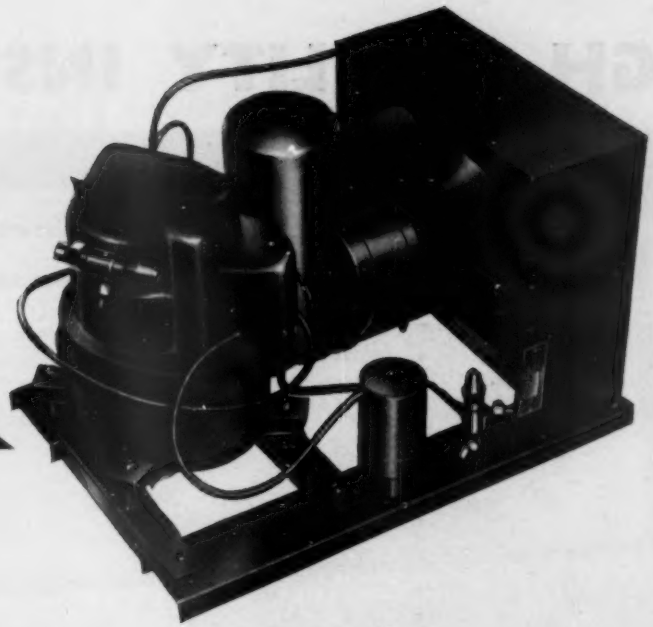

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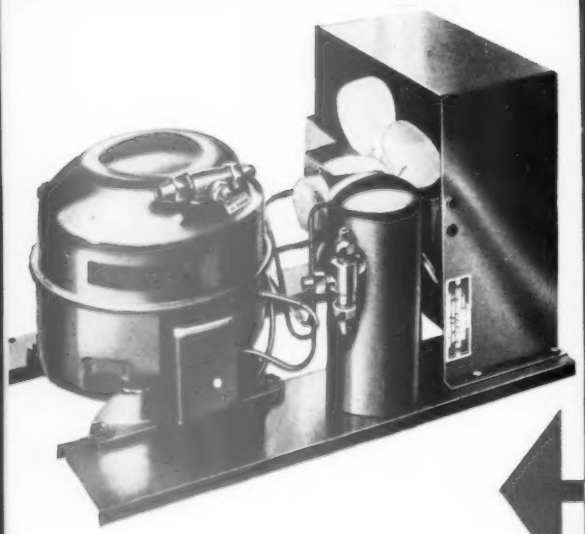

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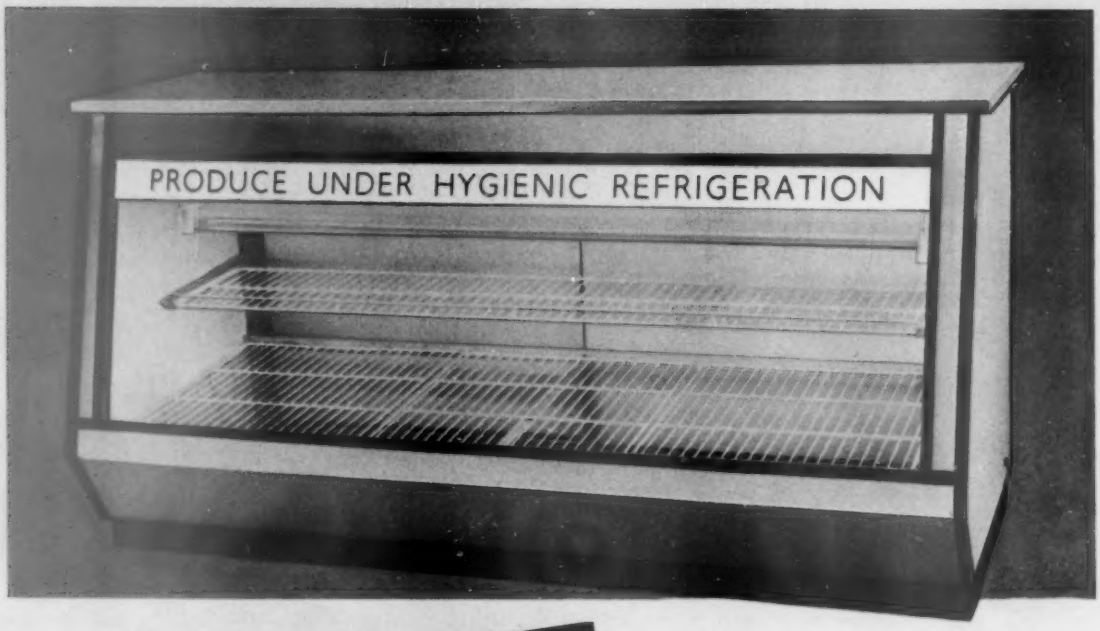

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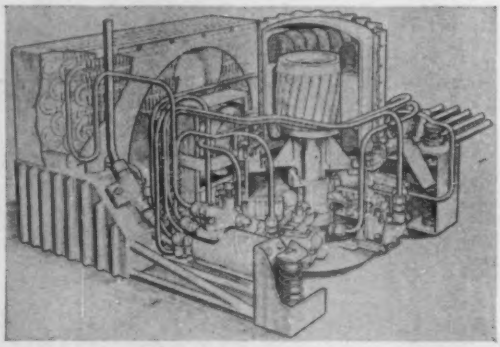

British Patent
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Australian Patent
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U.S.A. Patent
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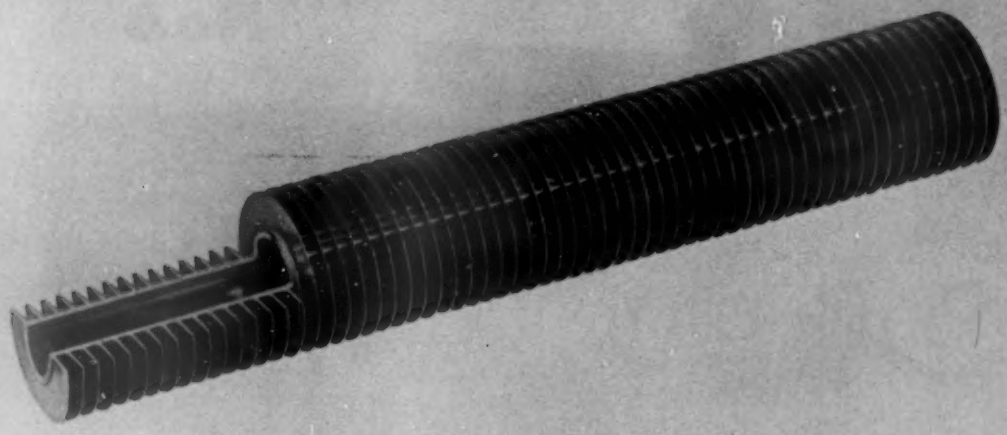

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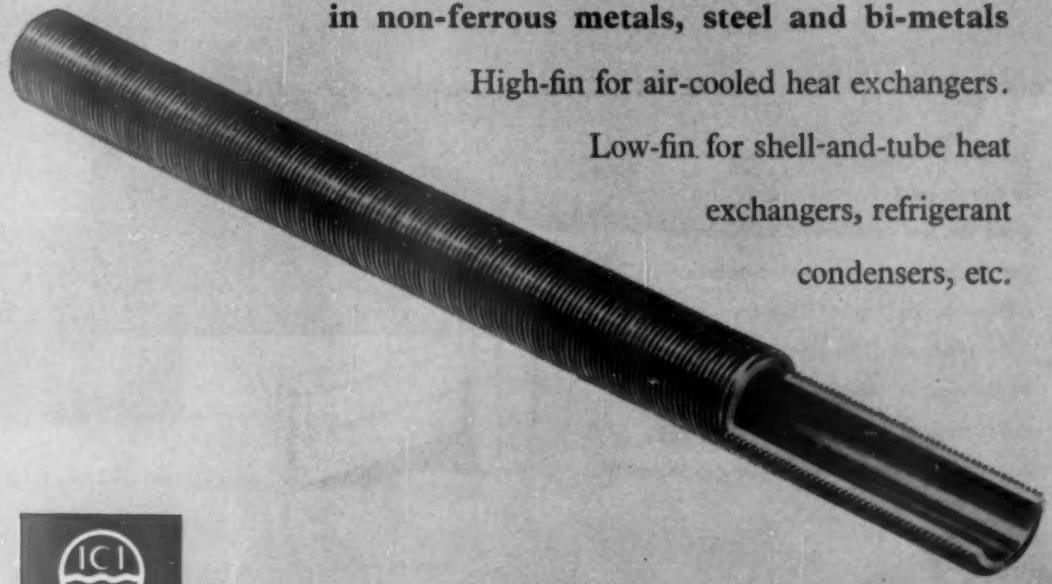

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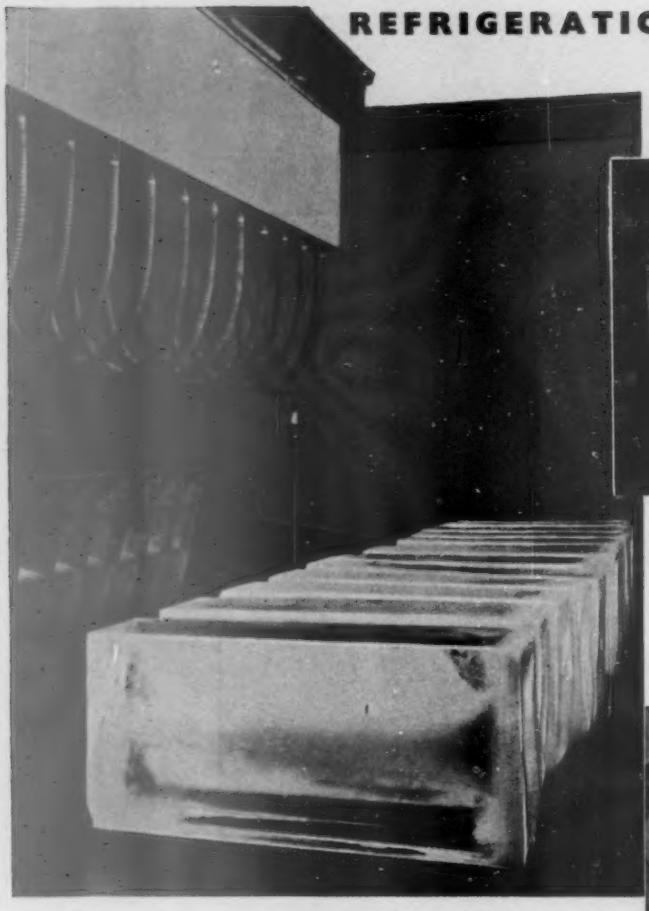

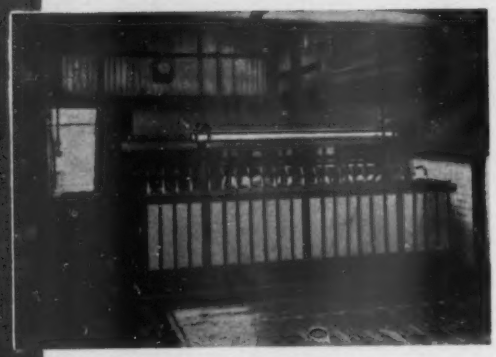

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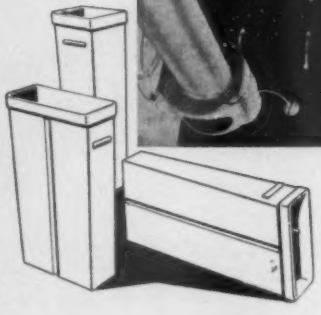

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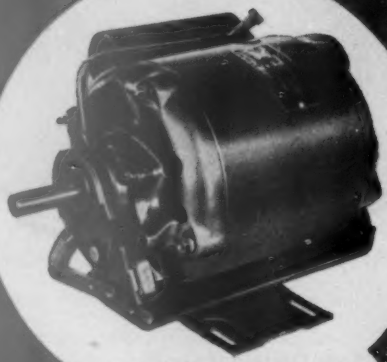

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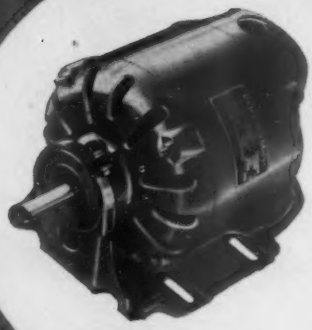

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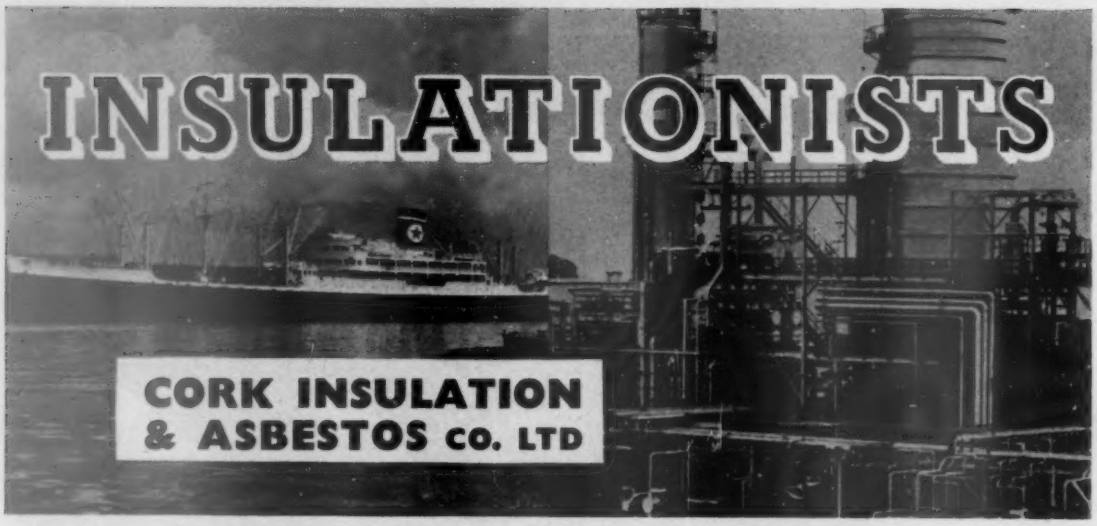

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Taylors of Mitcham

"OPINION"

"AT WHAT SPEED DO YOU DRIVE?"

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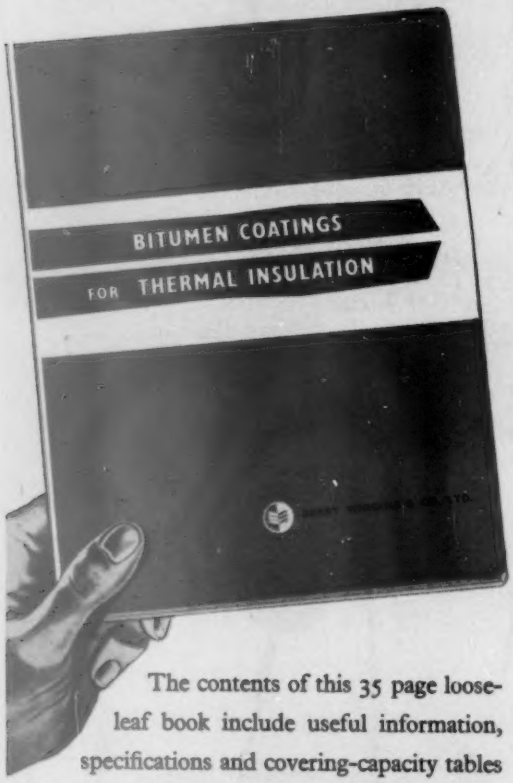

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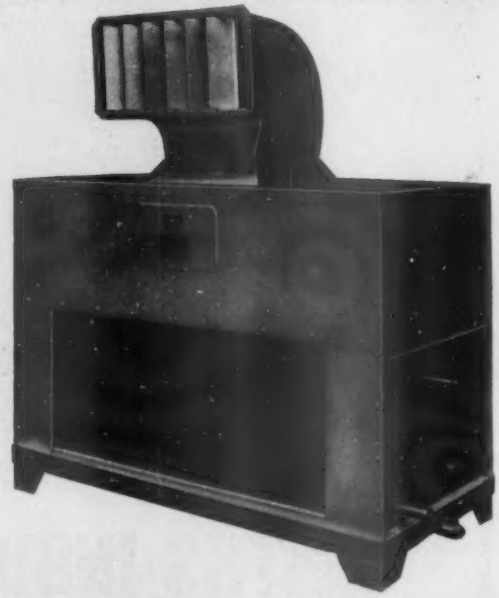

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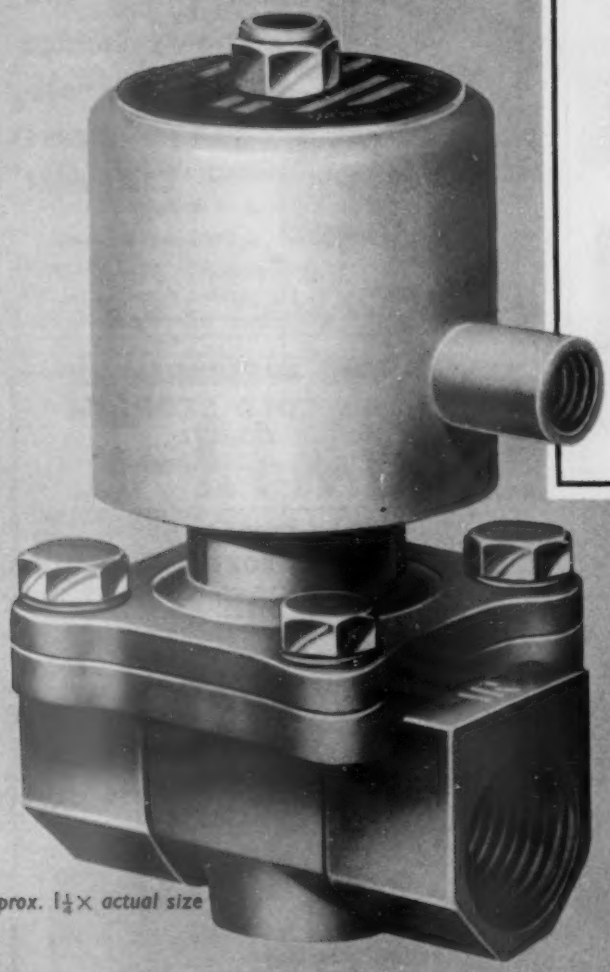

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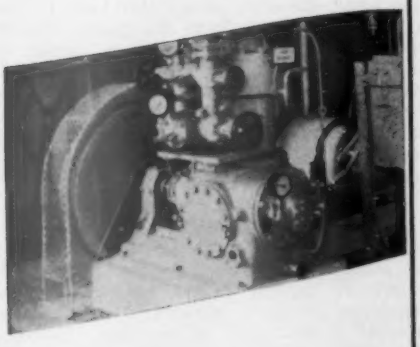

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June, 1959

Editorial . . . .

Plastics' Progress

Meat Marketing Departure

River Plate Shipping

● This June number of " M.R." is a Plastics Special. The impact of this " new " industry (which, surprisingly enough, is 100 years old—virtually a contemporary of our own) upon refrigerator production and upon the insulation trade has been so great that we could not let the International Plastics Exhibition and Convention (Olympia, June 17 to 27) pass without suitable acknowledgment.

● In this dramatic century since the discovery of celluloid, the first of the plastics, a tremendous range of materials have been produced and a complex technology has grown up with them. Development of plastics material has been rapid in the last twenty years. The total output in the U.K. just before the war was less than 30,000 tons per annum ; about twelve years ago it was approximately 100,000 tons, and now U.K. production tops the 400,000 tons mark. Although this tonnage is not as high as many other materials, say, the non-ferrous metals with which plastics compete in many fields, when the density of plastics is taken into account the volume of plastics material is considerable.

● Many of the leading authorities in the plastics field have agreed to grace our literary columns as will be noted upon turning to page 553 and reading through to page 580.

● A modern establishment opened at Luton last month breaks new ground in the meat marketing field ; its duplication in other parts of the country could spell the end of Smithfield as the pivot of Britain's meat system. Thus, there is some irony in the choice of name for these premises. Smithfield House, the new ultra-modern meat market in Luton, is the result of several years' research and the determination of Mr. A. Moorton Fisher to improve the standard of hygiene and efficiency in meat handling to-day. Together with the designer of Smithfield House, Mr. F. A. Jarvis he inspected the most advanced markets in Europe and brought back many ideas new to England. Combining these with his own considerable knowledge of the meat industry, he has produced a result so far unique in this country.

● Smithfield House has been designed with two objects in view—the minimum of handling of the meat, and the maximum of hygiene in every section. Starting at the abattoir a quarter of beef is hooked straight onto the rails of a company's vehicle, and the meat does not leave this hook until it is carried into the butcher's shop. In the meantime, it will have been conveyed to Smithfield House, automatically weighed, coded, numbered and dated ; displayed, bought, conveyed via overhead tracking back onto the vehicle and transported to its destination. On arrival the quarter is lowered to shoulder height by means of the latest type of hydraulically operated market loader.

● Perhaps the most striking section of the new premises is the refrigerated sales hall which occupies the larger part of the market, has a floor area of 1,500 square feet and is entirely under refrigeration. Entrance is made through air curtains which take the place of air locks or doors—other than those for security. Displayed in this fine hall is the bulk of the meat for sale ; it can hold in full view 500 quarters of beef. Special features are the lighting, refrigeration, décor and the complex array of overhead tracking which enables a quarter of beef to be moved with ease from any part of the hall without interfering with the movement of meat in other parts of the building.

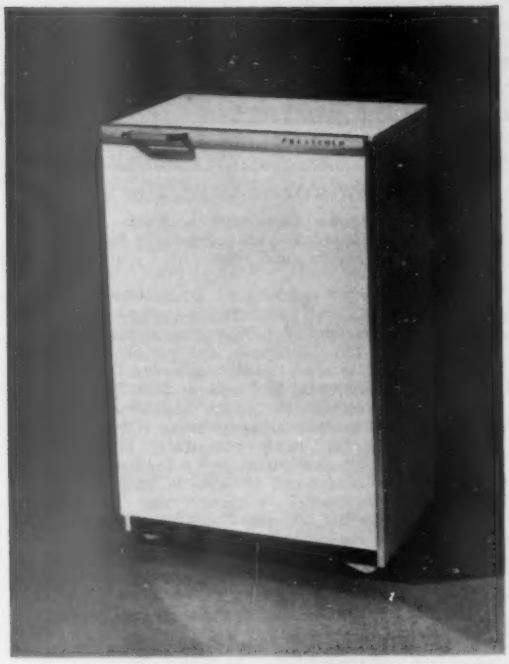
● Additionally, at Luton, there is a refrigerated display room which occupies 240 square feet and enables buyers to see cuts of meat, poultry and meat products, lambs and sausages, etc., displayed under attractive conditions in refrigerated cabinets. The meat cuts on display are identical with meat, etc., in the store rooms and are graded and classified accordingly.

● The winning of The Duke of Edinburgh's Design award by the small domestic refrigerator built by the well-known Oxford firm confirms the popular belief that most makers ought to standardize as quickly as possible on the " Sheer-Shaped " cabinet. After all, the cabinet with closely-radiused corners is the most cheaply produced, fits most easily into unit kitchen furniture and, to many minds, is pleasing aesthetically. Once this type is fully back in vogue, it will be with us for many years for tooling-up costs a fortune these days.

● The export services branch of the Board of Trade, most readers will agree, has done and is still doing a wonderful job for British industry and its advices concerning business offering overseas have never been more prolific than at this date. In commercial refrigeration, there is a tremendous demand to be met, particularly in the near and far east. This month we learn that the National Small Industries Corporation Ltd., New Delhi, is keen to have particulars of the cold storage plant which can be offered by United Kingdom firms, with details of sizes, prices and delivery dates.

● The Teheran Municipality is contemplating the construction of a new 4,500 tons (metric) cold storage ; the I.C.A. procurement for India seeks five window type air-conditioners ; the similar body for Vietnam also requires five air-conditioners—to quote only a few of the latest inquiries outside Europe.

● The annual report of Royal Mail Lines reveals that the " era " of the *Highland* ships is coming to an



Prestcold Packaway (*see page* 542, *column* 2)

end. These most efficient motorships have served the company well for thirty years. Besides providing very comfortable first-class travel from the River Plate, they have lifted many millions of hundredweight of Argentine beef during their career. The late Mr. A. R. T. Woods, past-president of The Institute of Refrigeration, will be remembered chiefly perhaps for his creation of these ships.

● Since the end of the financial year *Highland Chieftain* has been sold to a whaling company as a depot and storage ship, the Royal Mail report states. In all probability *Highland Brigade* and *Highland Princess* will be disposed of in September and December next respectively. *Amazon*, the first of the three new "A" ships to be laid down, will be launched in July and Her Royal Highness, the Princess Margaret, has honoured the company by graciously consenting to perform the naming ceremony at Belfast. It is anticipated that this ship will make her maiden voyage to South America in January, 1960. *Aragon* is to be launched in October and the construction of *Arlanza* is proceeding satisfactorily.

Tailpiece

"Selected members of the Canadian Air Force band are going to blow their hot licks real cool, man. Cold room tests will determine at what point in the winter thermometer readings bandsmen may, within the proprieties of military discipline, refuse to blow at frigid outdoor concerts."—*Air-Conditioning and Refrigeration News*, Detroit.

OBITUARY

Mr. Chester B. Morrison

We regret to announce the death in New York on Friday, May 8, of Mr. Chester B. Morrison, formerly chairman and managing director of York Shipley Limited, London.

Mr. Morrison graduated from Penn State College with a B.S. degree in engineering and joined the students' course of the York Manufacturing Company, York, Penna., in 1911. After completing his training as a refrigeration engineer, he saw war service with the American Forces in France during the First World War, and in 1920 went to Shanghai for the York Manufacturing Company. He founded York Shipley Inc. of China where he remained as president until imminent widespread hostilities curtailed all business activities.

Mr. Morrison was appointed managing director of York Shipley Ltd. and arrived in London in June, 1940. Under his able guidance the company contributed substantially to the war effort and through the period of rapid post-war expansion his ability and energy were invaluable in enhancing the company's place in the British refrigeration industry. He retired as chairman of the company in July, 1958.

He was a man admired throughout the world-wide York organization for his wide knowledge and his vitality. He made firm friends wherever he went and was regarded with affection by his business associates. On many Institute of Refrigeration (of which he was a member) trips in 1947 he was a

most endearing companion. Our sympathy goes out to his family whose sad loss we share.

NEWS OF THE MONTH

Refrigeration and A-c. Exports.—During April 1959, air-conditioning and refrigerating machinery (commercial and industrial sizes) to the value of £675,416 weighing 920 tons, was exported from Great Britain. Comparable figures for April 1958 were 1,248 tons, worth £772,470.

* * *

Exports' Analysis.—Of the 920 tons of air-conditioning and refrigerating plant worth £675,416 exported by Great Britain in April—quoted in the preceding paragraph—52 tons went to the Union of South Africa, 45 tons to India, 57 tons to Australia, 23 tons to New Zealand, 46 tons to Canada, 197 tons to "other Commonwealth countries," 39 tons to Eire, 16 tons to Sweden, 111 tons to Western Germany, 49 tons to the Netherlands, 37 tons to Belgium, 9 tons to France, 76 tons to Italy, and 163 tons to "other foreign countries."

* * *

Refrigeration Plant Classified.—Of the total exports of air-conditioning and refrigerating machinery during April, quoted in the first paragraph, commercial refrigerators accounted for 299 tons, worth £158,631, industrial plant and equipment for 130 tons, worth £112,569, and refrigerating equipment, and parts, including parts of commercial refrigerators, for 267 tons, worth £214 768.

* * *

Exports of Small Refrigerators.—During April, 1,185 tons of complete refrigerators and domestic refrigeration equipment were sent overseas from Great Britain. These exports were worth £772,479. The 1,185 tons comprised 24 tons to the Union of South Africa, 15 tons to Rhodesia and Nyasaland, 2 tons to India, 38 tons to New Zealand, 638 tons to "other Commonwealth countries," 27 tons to Sweden, 36 tons to Western Germany, 16 tons to the Netherlands, 17 tons to Belgium, 53 tons to Italy, and 319 tons to "other foreign countries."

* * *

Insulation for Ammonia Sphere.—Onazote Insulation Co. Ltd. have recently completed the insulation of a sphere at Flixborough, near Scunthorpe, Lincs. The sphere, used for the storage of liquid ammonia at 10 to 15 p.s.i. gauge, is at the plant of Nitrogen Fertilisers Ltd. It operates down to –20° F. The vessel has been insulated with 7 in. of Onazote in four layers. It is finished in bitumenized tape.

* * *

Frozen Foods in Scotland.—New frozen food outlets continue to develop in Scotland. One of the most interesting is the Collet-Macpherson Ltd. self-service shop which has been opened at Castlegreen Road, Thurso. This new unit has been designed to cover the growing atomic energy authority population in the Dounreay vicinity and is sponsored by two young north of Scotland men, previously in tea planting in India. Antony Collett comes from a family for generations in India. Ian Macpherson is a north-east man whose family had retail premises at Reay. Friends in India, they were on leave together and decided then to enter the retail trade, developing the original Macpherson business. That has now been

HALL-THERMOTANK MERGER PLANNED

Two well-known engineering companies, both of which have long-standing connexions with the shipping industry, announce that they are proposing to amalgamate.

The merger, if approved by stockholders, will be between J. & E. Hall Ltd., which is engaged principally in the manufacture of refrigerating machinery, and Thermotank Ltd., designers and manufacturers of all types of air-conditioning equipment. The new company, which would be known as Hall-Thermotank Ltd., would combine the design knowledge and the technical and manufacturing resources of both organizations. In the highly competitive international industries of air-conditioning and refrigeration, Hall-Thermotank Ltd. would be able to offer not only increased commercial efficiency and substantial technical benefits, but also better service to their customers, a considerable saving in costs and a more rapid development of new ideas.

An extraordinary general meeting of stockholders of J. & E. Hall Ltd. is being held on June 22, when they will be asked to approve the necessary resolution for the merger. The effect of the amalgamation will be that the present shareholders of J. & E. Hall Ltd. will hold 66 2/3rds per cent. of the ordinary shares of the new group and the former shareholders of Thermotank 33 1/3rd per cent.

The Peninsular & Oriental Steam Navigation Co. at present hold 52·3 per cent of the voting control of J. & E. Hall Ltd. After the merger, the P & O's interest in the new group would be 35·1 per cent.

Lord Dudley Gordon, the present chairman of J. & E. Hall Ltd., will be president of Hall-Thermotank Ltd. The chairman will be Mr. I. M. Stewart, chairman of Thermotank Ltd., and the deputy-chairman Mr. J. F. E. d'A. Willis, a director of J. & E. Hall Ltd. The other directors will be Mr. J. D. Farmer (joint managing director of J. & E. Hall Ltd.); Mr. A. Greenfield (joint managing director of J. & E. Hall Ltd.); Mr. W. S. Hayes (a director of J. & E. Hall Ltd.); Mr. F. McPherson (joint managing director of Thermotank Ltd.); and Mr. J. K. W. MacVicar (joint managing director of Thermotank Ltd.).

An offer is being made on behalf of the new organization to the shareholders of Vent-Axia Ltd., fan makers and manufacturers of ventilating equipment. The offer, which the board of Vent-Axia Ltd. recommend the shareholders to accept, is to acquire all the ordinary stock of Vent-Axia Ltd., at a price of 10s. 6d. per unit. If this offer is accepted, Mr. J. C. Akester, chairman and managing director of Vent-Axia Ltd., will join the board of Hall-Thermotank Ltd.

done and the new Thurso self-service unit added. Refrigeration is featured strongly in this opening, both in front and behind the scenes. Deep-freeze storage space has been installed in addition to the cold room to ensure that the store can handle the necessary volume of foods to meet all requirements. Emphasis is being placed on frozen and refrigerated foods, the deep-freeze cabinets providing fresh and cooked meats, fruit, provisions and fish. The firm is planning other developments in this area.

* * *

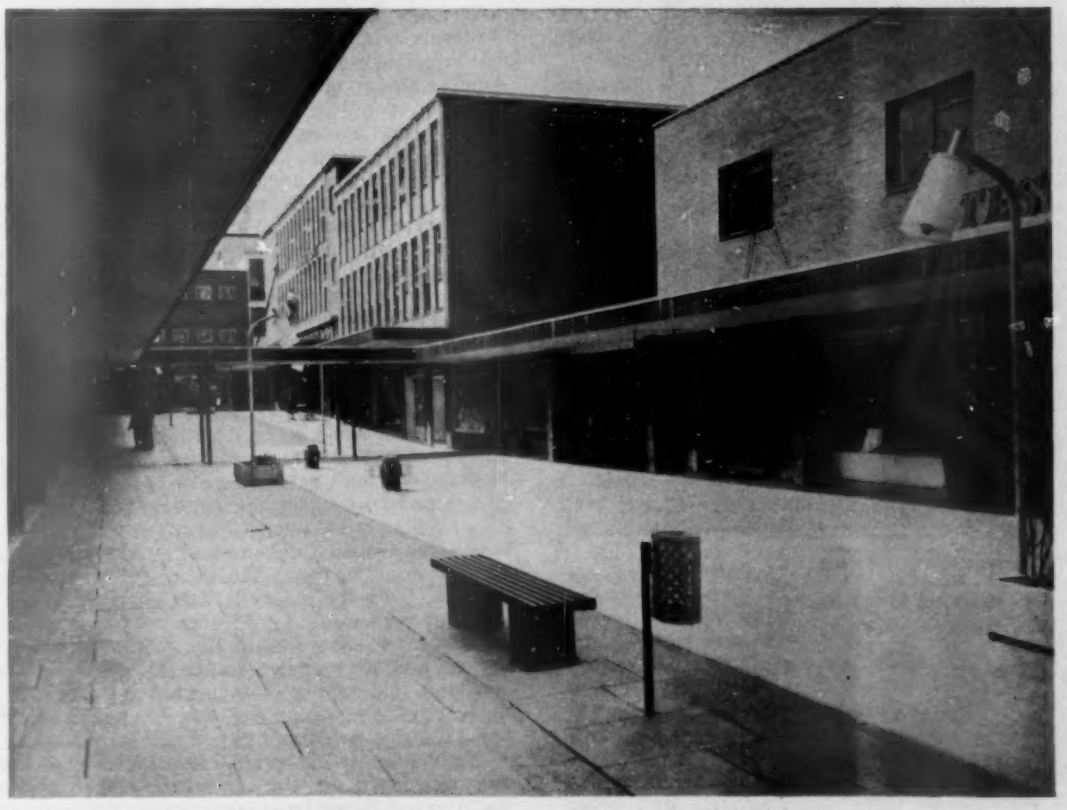
Sales of Domestic Appliances.—The following return shows the number of new appliances sold by area electricity boards in England and Wales for the month of March and for the 12 months ended March 31, 1959, together with percentage changes over corresponding periods of the previous year. When assessing the figures it must be borne in mind that the sales by area boards represent only a part of total sales throughout the country.

	Sales in month ended March 31, 1959		Sales in 12 months ended March 31, 1959	
	Total	Percentage change over corresponding period of previous year	Total	Percentage change over corresponding period of previous year
Cookers ...	28,374	+ 38·3	285,527	+24·8
Water heaters :				
immersion	12,528	+ 10·5	167,184	+17·6
storage ...	4,527	+ 13·7	52,060	+23·6
Wash boilers ...	5,770	− 20·2	77,950	− 2·1
Washing machines	10,008	+ 89·6	126,337	+76·2
Refrigerators ...	5,138	+134·1	82,687	+65·5

PICTURE OF THE MONTH ★

THE CHANGING FACE OF BRITAIN

During the recent Royal visit to Stevenage New Town, Her Majesty the Queen showed a great interest in the people and their way of life in this remarkable new background. In the new town centre Her Majesty unveiled a commemorative plaque, set in the clock tower, and named the main pedestrian avenue "Queensway." One of these buildings selected for a visit by the Queen was the butcher's shop, in Market Place (one of the main shopping avenues) owned by Mr. Geoffrey Shepherd, secretary of the local Master Butchers' Association. Inside the shop the Queen saw a baron of beef which, she learned, came from an animal off her uncle's estate at St. Paul's Waldenbury. Prestcold equipped, by The Bedford Refrigeration Co., Ltd., Mr. Shepherd's butcher's shop is very modern and attractive in its appearance. The window is dominated by a special 8-ft. marble-decked, refrigerated window display unit with automatic defrosting equipment.

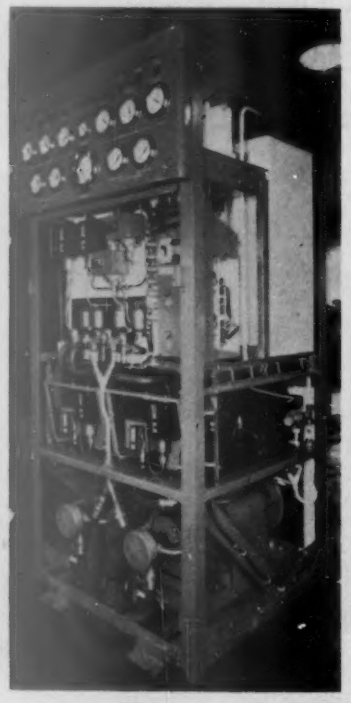


A Compressed Air Dehydration Unit

REFRIGERATION IN THE SERVICE OF "PRECISION WORK"

By J. W. REYNOLDS

A MACHINE which can supply an uninterrupted flow of air to zero humidity and clean to 0·5 micron, which is also fully portable, and which can operate continually 365 days a year, should prove



The type of unit supplied to Government order.

a boon to many branches of industry—as well as to hospitals, clinics and laboratories—who rely on clean dry air for vital research and manufacturing processes. Yet these are among the features of the Pathfinder air pump cabinet originally developed for the Ministry of Supply and now available for the first time in a commercial version.

Widely used in modern industry, clean air is nowadays essential to many manufacturing and other processes. Frequently, in applications such as the drying of films and the assembly of certain refrigeration and electrical components, dryness of the atmosphere is equally vital. Controlled atmosphere cabinets using bottled nitrogen can meet these requirements but entail the extra work and additional cost of cylinder replacement, with weekly or even daily deliveries of new cylinders. Another disadvantage of most conventional equipment is that to ensure the required degree of cleanliness, an elaborate filtration system is incorporated, contributing substantially to the initial cost of the plant.

The new Pathfinder cabinet eliminates both these problems by achieving dryness and cleanliness through refrigeration. In its standard form, the cabinet supplies 10 c.ft. per min. of air at up to 60 p.s.i.g. or 10 c.f.m. at 15 p.s.i.g. at any required humidity between zero and ambient. Occupying a floor area of less than 3 sq. ft., under 6 ft. in height, and fitted with castors, it can be moved easily from one workshop or laboratory to another.

The development of the new Pathfinder cabinet dates from early 1956, when the Pathfinder Automatic Defroster Co., of Hersham, Surrey, was approached by the Decca Organization to produce a machine capable of supplying air dry to 0·6 per cent., clean to 0·5 micron and at a temperature of 21° C. Research already carried out by the Pathfinder Company by that time—including the construction of rather similar equipment for their own use—enabled them in only seven weeks to produce a prototype fulfilling all the main Decca requirements. As a result, the Ministry of Supply gave authority for the construction of a second prototype using the same basic principles of construction and operation but more closely allied to the specialized requirements of the equipment with which it would be used. Finally, design approval was obtained from the Royal Radar Establishment and the company went into production on a firm Ministry contract. The success of the Ministry version and the obvious need for a similar machine for sale to industry in general led to the subsequent introduction of a commercial version of the cabinet, based on the original Ministry requirements but of larger capacity.

The Pathfinder air pump cabinet provides clean, dry, pressurized air, the air being supplied by two Williams and James horizontal two-stage compressors

of the oil-free carbon ring type for pressures up to 60 p.s.i.g. at 10 c.f.m. or alternatively a fully rotary type compressor with an output of 10 c.f.m. at 15 p.s.i.g. Initial filtration at the compressor intake is by means of a Vokes type HDI five-ply filter. To obtain greater efficiency through maximum pre-cooling, the output of a fan mounted on the end of

The model now available to industry.

the motor shaft is directed by a two-way ducting to the compressor heads in the case of the 60 p.s.i.g. compressors. Where the 15 p.s.i.g. compressor is used, the compressor itself has its own built-in cooling fan. The suction side of both types of compressors is in heat exchange with the low temperature dehydrated air and provides a "lower than ambient" intake to the compressors.

The output from the compressor passes to a "compressed air to ambient" heat exchanger, or aftercooler. A suitable trap device ensures draining of the condensate at this point. From the aftercooler the air is piped to the dehydration unit, which is designed to reduce the air temperature to –40° C. and subsequently reheat to ambient. Provision is made to prevent ice particles from being carried through to the outlet of the machine.

The reduction of the air temperature to –40° C. and reheating to approximately 21° C. results in a relative humidity of 0·641 per cent. at the air outlet from the machine, at 15 or 60 p.s.i.g. Where this air is used to pressurize assembly cabinets or similar equipment at pressures lower than that of the machine output, a marked improvement on the relative humidity is obtained.

For example, air at –40° C. dew point (100 per cent. saturation level) and at 40 p.s.i.g. contains 0·052 grains of water per c.ft. By reducing the pressure to 10 p.s.i.g., the dew point is automatically reduced to –47·2° C., containing 0·0325 grains of water per c.ft. Where required for controlled condition experiments or other special applications, the equipment can, of course, be factory set to give any higher humidity up to ambient.

At 60 p.s.i.g. the output of the cabinet is better than 5 c.ft. per minute per pump, and at lower pressures there is a corresponding rise in the rate of flow, using the two-stage carbon ring type compressors previously mentioned. Should higher rates of flow be desired, the fully rotary compressor would deliver up to 15 c.f.m. at pressures not more than 7 p.s.i.g. As a safety measure, the equipment incorporates a pressure relief valve adjustable up to 120 p.s.i.g. The cabinet is also provided with an external connexion for coupling to a factory air line to allow pressures and rates of flow in excess of those provided by the alternative built-in compressors, the refrigeration plant being adequate for flows up to 20 c.ft. per minute.

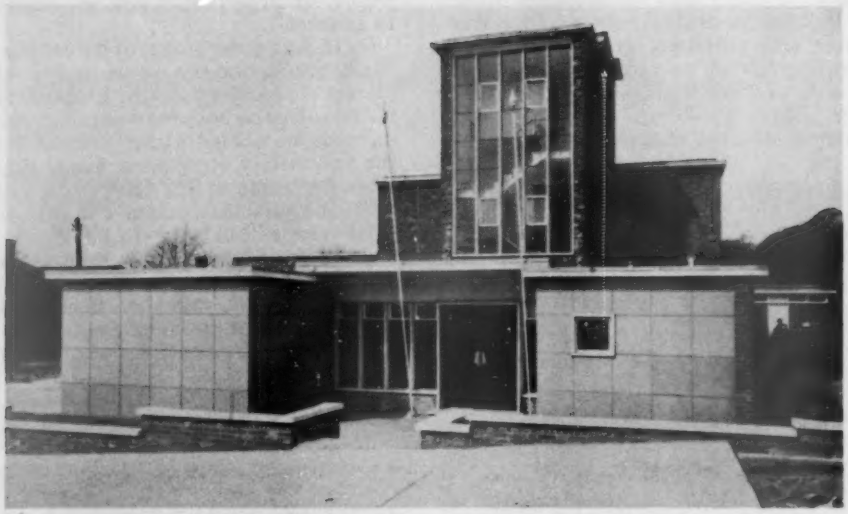
The dehydration unit which contains the "compressed air to refrigerant" heat exchanger assembly is designed to operate with a refrigeration condensing unit employing monochlorodifluromethane (known as "Arcton-4") and is capable of giving a continuous air outlet dew point temperature of better than –40 °C. for a period in excess of 12 hours. It is constructed in duplicate, so enabling a continuous cycle to be performed indefinitely.

The ice build-up resulting from dehydration is dispersed by a Pathfinder automatic defroster, a unit already familiar to the refrigeration industry and to many butchers and provisions merchants with large cold rooms or frozen food stores, which it enables to operate without the bugbear of periodical manual defrosting. In effect, the defroster simply reverses the refrigerating plant in one-half of the dual equipment so as to act as a heat pump, the required low temperature being meanwhile maintained by the other half. The automatic cycle provides for alternate six-hourly periods of operation by each side of the equipment, and to ensure the right take-over conditions refrigeration of one side commences 10 minutes before the other side ceases to function. This allows over five hours for defrosting, although the minimum period necessary is only one hour. In the unlikely event of a failure of either side, the remaining half of the dehydration unit will operate for 12 hours before defrosting becomes necessary.

Condensate formed during defrosting is carried away to an automatic drain. An important feature of the Pathfinder cabinet is that any particles of oil or solidified matter which have passed the initial filter are removed from the air during the dehydration process, being trapped in the ice field and drained away with the condensate. This effective method of dirt removal provides cleanliness to 0·5 microns and obviates the need for an elaborate filtration system.

In addition to providing for removal of the condensate, the automatic drain has two other functions. Firstly it serves as a small reservoir of air, and secondly it provides a water washing action which still further ensures cleanliness of the air. A drain plug and filter provides for removal of dirt from the

(*continued on page* 596)



Main entrance to new premises.

New Approach to Meat Handling and Marketing

THE new Luton Meat Market—appropriately named Smithfield House—opened last month is the most modern establishment of its kind in the country and, so far as can be ascertained, there is nothing comparable in Europe. The nearest would appear to be located in Los Angeles, California, U.S.A. The Luton Meat Market is far more than an imposing building in which meat is displayed for the purpose of attracting trade buyers. It is, in fact, a long-cherished dream come true.

It was conceived by a man who was literally born into meat marketing—a man who has a life-long knowledge of the trade and its problems in wholesaling, and whose dream has now solved these problems in no uncertain way. The name of Fisher has been to the fore in all fields of meat distribution throughout north London and the southern and home counties ever since Mr. Francis Fisher, J.P. commenced his business life in Watford at the end of the last century. With the sale—comparatively recently—of the large wholesale business operated from Watford, it seemed that this valuable connexion would be lost.

Mr. A. Moorton Fisher, grandson of the founder and son of Mr. Arthur Fisher, well known in meat circles in Luton and the home counties, felt that steps should be taken to safeguard these wholesale connexions ; and to this end started a similar business known as The Luton Meat Company operating from premises in the centre of Luton. It soon became obvious that larger premises were a dire necessity and a site was acquired at the junction of Crawley Green Road and Crescent Road, Luton.

Mr. A. Moorton Fisher's vision in planning the new Luton Meat Market has been based upon his profound knowledge of the wholesale trade and its requirements. From the outset, he was determined to set the very highest standards of hygiene and efficiency and long before work was started on the actual design, he, together with Mr. F. A. Jarvis of Messrs. Jarvis (Harpenden) Ltd., spent many months visiting the most modern meat markets in Europe.

An intensive study of marketing and handling methods was made and their resultant observations were allied to their own far-seeing thought and ideas.

Maximum hygiene, minimum handling together with ultra-modern refrigeration and lighting were to be the keynotes of the new building where butchers over an area exceeding 1,000 square miles would buy their meat and poultry. Smithfield House—headquarters of the Luton Meat Company—is now complete and is, without doubt, the most modern building of its kind in existence in this country today.

Detailed planning—which commenced in December 1957—goes right to the source of supply—the abattoir—where, in actual fact the Luton Meat Company becomes operative. When a quarter of beef is taken from the abattoir, it is placed on a hook, hung from the tubular overhead rails of the company's stainless-steel bodied vehicles. From that moment the meat will not leave its hook until it is portered into the butcher's shop.

Before the butcher takes delivery, that same quarter of beef will have been conveyed from the abattoir to Smithfield House, where by means of an ingenious method detailed later, it will travel off the rails in the vehicle on to the overhead rails at the wholesale centre. It is then automatically weighed, coded, numbered and dated before being slid effortlessly along the complicated array of overhead rails into the refrigerated sales hall or freezer.

When sold, the meat is conveyed back again along the overhead tracking on to corresponding tracking in the company's delivery vehicles and transported to the buyer's premises. The latest type of hydraulically operated Market Leader of the conventional type has been modified to the company's

requirements, and on arrival at the delivery point, the meat is lowered to shoulder height under automatic control, for final porterage.

This is the first and only time the quarter of beef is actually manhandled or moved from the hook upon which it was placed in the abattoir. In comparison with the generally accepted methods of handling, trucking and marketing, this unique method is an outstanding achievement, both in the hygienic sense and in the vast amount of time and labour it saves.

Construction and Amenities

Ultra-modern both in conception and design, the Luton Meat Market begins life as a two-storey building constructed in reinforced concrete, designed by Mr. F. A. Jarvis and built by his firm, Messrs. Jarvis (Harpenden) Ltd. On approaching Smithfield House from the centre of Luton—a matter of a few 100 yards—the spaciousness and careful planning are at once obvious.

Three gateways—all from Crescent Road—give access ; entrance and exit are by separate gates to ensure freedom of movement and smooth flow of traffic. An unusual feature here is that both gates are under remote control from one of the control offices which flank the main loading bay. The latter is approximately 80 ft. long with ample space for six large vehicles. Two of the positions are allocated to " in " traffic —one for frozen meat etc. and the other for chilled and home killed meat. The remaining four are " out " positions for the company's delivery fleet. The " in " points have been planned at opposite extremities of the loading bay and are, therefore, adjacent to the two control offices mentioned above.

These offices are the nerve centres of the Luton Meat Market and from them, all movement, outward or inward, is controlled. They contain the working heads and automatic printing mechanisms of the scales, which were installed by Messrs. Berkel Ltd.

These control offices resemble airport control towers inasmuch as they are mainly of glass construction giving the controller visibility in every direction. There are many instances which serve to indicate the immense thought given to the customers' problems at wholesale centres. Some have already been mentioned.

Another—and one which will fulfil a long-felt need—is the fact that the planners of Smithfield House appreciated that often a buyer will want to communicate urgently with his head office or shop. This contingency has been provided for by the installation of sound-proof telephone booths. These are similar in style to the Continental type in that they eliminate all noise by virtue of their shape and the material used in their construction. The company's own staff will also use them to phone customers who for one reason or another are unable to attend the market. While dealing with this high degree of customer well-being, mention must be made of the reception office opposite the high level entrance. Centrally heated from the main system, this office contains an enquiry and reception desk and facilities for the payment of accounts. It also has access to the main staircase to the first floor suite of administration offices. The staircase features a scarlet plastic handrail, contemporary in design and supported on a wrought iron balustrading. The latter was made at the blacksmith's forge of Mr. H. Ward, of Batford, Herts, and is one of those rare examples of the art of a fast-dying craft being applied to modern requirements, for the shoeing of horses is still carried out on the same premises.

The ground floor accommodation includes the unique sales hall, loading bays, freezer, offal room, cutting room, cuts and products display room, control offices, rest room and toilets and buyers' reception office.

The single 30 ft. span of the sales hall is required to carry a heavy meat load and this has been made possible by having deep beams at 10 ft. centres, the space between these beams being used to house and conceal the cooler units.

As mentioned, the first floor contains a suite of administration offices and a rest room for the clerical staff. At the moment there are nine offices, and provision has been made in the structural design for the addition of another floor.

At the rear of the building is the plant room which contains the compressor equipment and the re-cooler. Adjacent is the boiler house, which at present contains equipment for heating the office block and other ancillary rooms as described. It has, however, been designed to house further equipment and has been provided with an additional chimney to handle a heating load of up to 1,000,000 B.t.u./hr.

The Luton Meat Market has been blue-printed for future extension and enlargement, for quite simply, provision is made for extending the ground floor both to the rear and upwards. In addition, the overall design allows for the construction of another floor when this becomes necessary.

Refrigerated Sales Hall

This is one of the most unique features of the whole building. It occupies the larger part of the market frontage, has a floor area of 1,500 sq. ft. and is entirely under refrigeration. It is interesting to note that no matter where a particular quarter of beef may be hanging, easy access by the buyer is possible.

Incidentally, before entering the sales hall, every customer will be handed a clean white overall coat. This serves not only for the protection of the buyer's clothing but is also consistent with the extremely high standard of hygiene which is enforced throughout the whole organization. The protective clothing was designed specially for the purpose by the S.W. and W.E. Standard Manufacturing Co. Ltd., and the garments carry the Luton Meat Company's name in red embroidery on the breast pocket.

Rows of meat suspended from racks in the ceiling in a cool hygienic atmosphere at a temperature of about 45°F. The hall has a capacity of 12,750 c.ft. At the top right can be seen the special diffuser grilles which comprise outlets for cold air and inlets for warmed air.

The freezer room is built with a mezzanine first floor to augment storage space and has a gantry to lift heavier items. Cooling is by two cooling units which, operated by a Prestcold 7½-h.p. water-cooled condensing unit, maintains a temperature of 10°F.

Each customer will be accompanied by a member of the sales staff as he enters the sales hall, where hangs for display and sale, the bulk of the meat. This splendid sales hall can rightly be said to be the business hub of the Luton Meat Market. One of the many features of the sales hall is the lighting which was specially designed to ensure that the meat was shown to its best advantage.

The decoration is in a light pastel shade of green and the floor is squared granolithic cement in grey squares with red intersections and the general appearance is that of hygiene and modern efficiency.

At the entrance (as in the case of all the refrigerated rooms) is an air curtain which disposes of the need for airlocks or doors—other than for security. Thus, customers just walk from an outside temperature of, say, 75° to 80° on a summer's day, into refrigerated conditions without cold air escaping from or warm air entering the rooms.

The windows in the sales hall are the well-known double glazed " Insulite " units manufactured by Pilkington Brothers Ltd., and look out on to the loading bays. Overhead is part of the complex system of tubular tracking upon which the meat is transported. Such is the perfection of the system that even if a customer requires a quarter of beef which is hung in the far corner of the hall, it can be conveyed over the system with no humping or manhandling—all in a matter of seconds and without interfering in any way with the movement of other quarters.

Cutting Room

As in all branches of wholesale distribution, the specific requirements of retailers vary in accordance with the actual requirements of their customers. As an example, a butcher regularly serving hotels and restaurants would probably require more steaks than the butcher on the village green. The former would not always want a whole carcase of lamb or pork, or a whole quarter of beef. He is more likely to buy rumps and loins which can be served as steaks.

To meet the requirements of butchers who want " cuts " of meat, the cutting room at the Luton Meat Market has been designed and equipped with foresight to ensure efficiency and, as always, the utmost hygiene. It is tiled from floor to ceiling in a pastel shade of cream and is linked by telephone to all parts of the building. In addition, the overhead tracking is connected to the main system, again eliminating manhandling and saving valuable time. Another unique feature is that it is refrigerated and fitted with central heating. Thus, the cutting room is maintained at an equable temperature under all external conditions and the meat is always in absolutely the right condition. Yet another facility is the provision of a sink with hot water supply.

The bulk of the cutting is carried out on a heavy duty electric meat cutting machine of the most modern design.

Freezer

The freezer adjoins the main sales hall and has been designed with two levels of storage, which in itself is at variance with the conventional freezer. Its capacity approximates 8,000 c. ft. and the maximum utilisation of space allows for the storage of around 100 tons of carcases at one time. Handling is again reduced to a minimum. Overhead tracking is connected to the main system and high in the roof is located an electrically operated gantry which is contructed and installed to allow freedom of movement from front to back of the freezer.

In addition to the overhead tracking, the conventiona method of tracking is also used, particularly in regard to the movement of lamb carcasses into and out of the freezer. By

In the well-equipped cutting room, a Prestcold forced-air cooler is operated by a 1-h.p. water-cooled Super-Presmetic condensing unit situated at the rear of the building.

Part of an array of seven Prestcold condensing units which altogether have more than 25-h.p. output. Water-cooled, all the units are stored neatly out of the way in a special room at the rear of the building, arranged on concrete platforms along two sides of the room.

means of the gantry, mechanical handling of loaded trucks is possible, again without actually being handled by the staff. Each of the trucks—by the Kings Cross Truck Company Ltd.—can be craned with a 7 cwt. load. They are all constructed to fit the weighing platform adjacent to the control office and outside the freezer doors. For rapid caculation of each load, the trucks are made to the same unladen weight and are painted with colour coding for easy identification as to the type of load and the department to which it has been allocated. The floor area of these trucks is over 100 sq. ft. with the sides built up to a height of 24 in. They have a steel floor and the bottom of the built-up sides are radiused for easy cleaning. To facilitate and ensure cleanliness all essential parts are galvanised. The craning hooks are located and designed to serve also as pushing handles and the chassis have tubular steel bumper surrounds to avoid damage to walls, conventional doors and rubber push-through doors. The short ends of these surrounds are also rubber-sleeved for additional protection.

Store Room and Rest Room

Leading off from the cutting room is the store room which is also the location of the main electrical switchgear. This room is heated from the main central heating system.

At the western extremity of the loading bay a staff rest room is provided.

Refrigerated Display Room and Store Room (Refrigerated)

Immediately behind the high level entrance is another outstanding feature of Smithfield House, the display room, which has been specially designed to accommodate refrigerated display cabinets and occupies 240 sq. ft. Exhaustive experiments were carried out to determine the precise shade of lighting which would show meat allied products to the best advantage, and buyers are at once struck by the effectiveness of the results.

It is in this special display room where customers will be able to see cuts of meat, lambs, poultry, pies, sausages and indeed, all the many products with which the Luton Meat Company is associated.

Normally it is the procedure for buyers to enter a freezer, and this display room will without doubt be acclaimed by purchasers as another big step forward in the meat marketing world.

The products and meat cuts on display are all classified and graded and are identical with meat etc. in the freezer or storage room. This storage room adjoins the sales hall and provides storage space of 300 sq. ft. It is divided into two separate compartments for the storage of offals and poultry.

Overhead Rail System

The overhead tracking or monorail system forms a vital part of the highly organised movement of meat at Smithfield House, where manhandling of carcases or quarters of beef is virtually eliminated. The installation of "Locwil" overhead runway equipment allows for the movement of large quantities of meat speedily and with minimum effort.

It is believed that this is the first time a successful link up has been achieved between a building and vehicles with tubular tracking.

As a safety precaution, an electrical circuit is wired into the vehicles and so arranged that a red warning light is automatically switched on when the connection between vehicle and building has been made. This, of course, warns the driver of the position at the rear of his vehicle and he can at once see when he is "free" by the green light which is automatically operated when the connection on to the tracking of the building is "broken."

Customers do not always require their purchases to be transported by the company's transport fleet, for many of them have their own vehicles. To avoid the necessity of porterage from the loading bay or the sales hall, the overhead rail system is extended to the high level entrance to Smithfield House, advantage being taken of the natural sloping site.

Messrs. Lockerbie & Wilkinson (Tipton) Ltd., were responsible for the manufacture and installation of this special runway system.

Amongst the new equipment installed in the Luton Meat Market—which is one of the reasons it is described as the most modern of its kind in Europe—are the up-to-date communications, voice paging and synchronized time systems installed by Telephone Rentals Ltd.

Refrigeration

The whole of the refrigeration installation was entrusted to the Bedford Refrigeration Company Ltd., and from the outset of the project Mr. Moorton Fisher made it quite clear that the Luton Meat Market must be the most modern refrigeration installation of its kind in the country. Before the final design was settled he travelled widely both in this country and on the Continent with Mr. F. A. Jarvis, the designer, and inspected many of the latest type of wholesale meat markets, making notes of all salient points. These points and many other ideas were all thoroughly investigated with the consideration of his own building in mind. He is convinced that the installation at Luton is the finest anyone can see in this country. The main theme is hygiene and service to the customer and to this end the whole design of the building and refrigeration equipment was made to a definite plan.

The main feature is the sales hall which has a capacity of 12,750 c. ft. of actual usable refrigerated display space. This hall is unique inasmuch as it is designed to be completely clear of refrigeration equipment and has an air circulation which maintains the correct temperature and at the same time giving comfortable conditions to both customer and staff when working, inspecting or purchasing meat.

Over the sales hall there is a false ceiling forming ducts across the hall in which five UCS 1200 Prestcold coolers are fitted. These ducts have special diffuser grills for inlets and outlets together with an adjustable by-pass to maintain the air flow to the conditions required. This means that the flow of air is uniform throughout the whole of the insulated space.

The refrigeration in the sales hall is comprised of two separate sets of equipment. One is a 6-h.p. water-cooled WR 600 Prestcold condensing unit working in conjunction with three Prestcold UCS 1200 coolers, the other being a 5-h.p. water-cooled WR 500 Prestcold condensing unit with two UCS 1200 coolers.

Along the south side of the sales hall, which overlooks the main entrance, is a specially designed loading bay. The sales hall wall has dual glazing fitted over its full length which is a novel feature that admits full daylight and greatly enhances the appearance of the hall.

Situated at the end of the sales hall are the poultry and offal rooms operated by a 3-h.p. water-cooled WS 300 Prestcold super-presmetic condensing unit with two ED 1200 Prestcold coolers which are also mounted in the ducts formed by the false ceiling. These rooms maintain a constant temperature of 34° to 36° F.

At the other end of the sales hall a freezer room has been constructed; this is of unique design inasmuch as the aim was to make the best use of the space available and for this reason it was built with a mezzanine or first floor. This floor is specially constructed with an opening in the centre through which a gantry can work and whilst obviously the larger carcases will be stored on the ground floor, it is no problem to store frozen lambs etc. on the mezzanine floor, this being built with special ducts away from the outside walls to ensure a free passage of air.

Two Prestcold ED 2400 cooling units are mounted in the mezzanine section, these in conjunction with a 7½-h.p. WR 750 water-cooled Prestcold condensing unit maintain a temperature of 10° F. in the freezer room. The opening in the mezzanine floor can be boarded over for peak periods in order to increase storage space still further. The internal capacity of the freezer room is 10,000 c. ft.

For the convenience of buyers and to avoid continual entry into the freezer, poultry and offal rooms, a special display room has been incorporated in Smithfield House, and Bedford Refrigeration have designed and constructed three special "Selserva" open top refrigerated displays. One of these is of extra width to display the various grades of frozen lamb. More than 12 lambs can be conveniently shown in this case and to assist in display and inspection, special wheeled trolleys run along the length of the base so that carcases can be positioned as required. This case is complete with automatic defrosting evaporator. The other two cases are situated on either side of the display room. One is again a low temperature case for the display of offal and other small lines. The third "Selserva" unit operates at a higher temperature and will be used for the showing of poultry and manufactured products. Messrs. Keens Ltd., of Watford will be well represented here as Mr. Moorton Fisher is also managing director of that company.

Ten-ton refrigerated lorry, one of a large fleet.

All the "Selserva" cases are, of course, operated by Prestcold condensing units.

At the other end of the market is a well-equipped cutting room which is air-conditioned by a Prestcold UCS 560 cooler operated by a 1-h.p., water-cooled, super-presmetic Prestcold condensing unit.

The condensing units for operating all the refrigeration equipment are situated in a special room at the rear of the building. The machines are arranged neatly on special concrete platforms along either side of this room and consist of seven condensing units amounting to over 25-h.p. of refrigeration. All these condensing units are water cooled and there is a Heenan Marley water recooling tower situated at the rear of the building to ensure maximum economy in the consumption of water.

Other general features of the installation are level floors throughout to enable the future use of pallet trucks if necessary and for this reason sweeper gaskets have been used on all doors. The doors have been designed to open inwards for clear entry. Whilst they are open, air curtains ensure that the temperature loss is kept to a minimum.

The refrigeration scheme has been completely designed in conjunction with Mr. Moorton Fisher and Mr. F. A. Jarvis by the Bedford Refrigeration Co. Ltd., who were responsible for all the insulation work which has been carried out in expanded polystyrene, except the floors which are insulated with slab cork. The Bedford Refrigeration Co. Ltd., also positioned and installed all the Prestcold refrigeration equipment and advised Mr. Moorton Fisher on the general layout of the rooms and halls concerned.

Throughout the whole project Mr. Moorton Fisher agreed

(*Continued on page* 596)

A Message specially contributed
to MODERN REFRIGERATION

by **SIR MILES THOMAS, D.F.C.**
Chairman, Monsanto Chemicals Ltd.

on the occasion of our PLASTICS NUMBER

PLASTICS
IN THE REFRIGERATION INDUSTRY

MY first contact with the refrigeration business was more than 30 years ago when the coachwork requirements of the then Morris Motors brought into being the Pressed Steel Company. The name " Prestcold " for their refrigerators was originated by me during the course of a conference at Oxford.

Since then, apart from my domestic use of its products, the industry and I have taken divergent paths until a little over two years ago, when I came into the chemical and plastics industry. When the Pressed Steel Company was formed, plastics were only of minor significance in the manufacture of refrigerators, or anything else for that matter. Nowadays it is impossible to conceive of a contemporary refrigerator without them.

The modern domestic refrigerator contains, on the average, 10 or 11 lb. of plastics, which, in view of the lightness of such materials, is a high figure. It is still increasing and this fact, if I may say so, seems to me to be very much to the advantage both of manufacturer and user.

Commercial refrigeration, too, is benefiting from the rapid development of new uses for thermoplastics. Here the greatest advances concern foamed polystyrene, which is increasingly favoured as an efficient and practical insulant in cold stores.

This use of plastics, particularly when polystyrene such as is made by my company represents such an overwhelmingly large part of it, is naturally a source of considerable satisfaction to me and to our industry. We are happy that our materials should be a basic raw material for another growing and forward-thinking industry. We are also delighted because the refrigeration industry is using these important new materials as they *should* be used—not as substitutes but because they have an important contribution to make in their own right.

They have brought colour into the kitchen—itself a pleasing and highly desirable revolution. They have permitted strength to be combined with lightness, functional efficiency with what is aptly called " eye-appeal " and—significant to manufacturer and customer alike—ease of production with what, comparatively, is a remarkably low selling price.

It is greatly to the credit of the industry that it turns out a product which, allowing for the difference in the basic value of money, is far more efficient and yet cheaper than it was 30 years or more ago. True, there is still a long way to go before every home has a refrigerator but this, I am convinced, is only a matter of time.

Plastics, then, have formed a mutually profitable alliance with the refrigerator manufacturer, and as you are always trying to turn out a better product so we, in our own field, constantly endeavour to improve our existing materials and to develop new plastics which will enable us to participate to an even greater extent in your progress. This year's International Plastics Exhibition, which I hope many of you will be visiting, will give you an indication of what success we are having.

Miles Thomas.

PROGRESS IN POLYSTYRENE

By A. J. B. LANG*

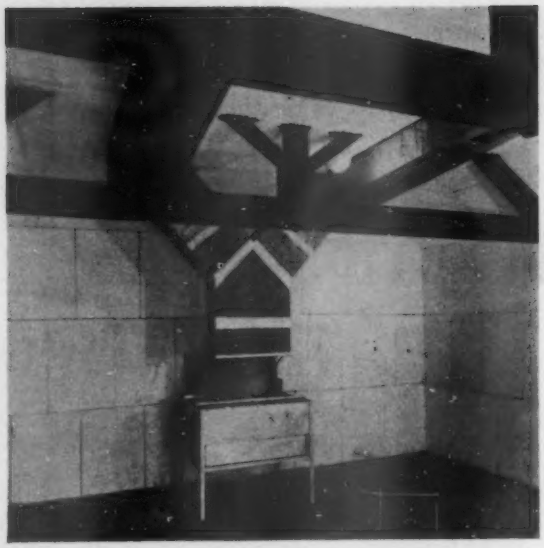
A RECENT review of the British plastics industry in *Shell Magazine* estimated that in 1958 23 per cent. of all polystyrene produced in Britain went into the manufacture of refrigerators. There is little doubt that as newer grades of this most versatile of all modern plastics materials become available and manipulation techniques are developed so more and more polystyrene will be used in the manufacture of refrigerators.

Among the foremost producers of plastics materials in the U.K. are Styrene Products Limited, an associate of Shell Chemical Company, and pioneers in the manufacture of raw materials for the refrigeration industry.

They began producing polystyrene at their plant at Carrington (previously known as Partington) near Manchester in 1950 and since that time have introduced more and more grades of the material " tailor-made " for specific jobs not only for the refrigeration industry but for other outlets too.

Styrene Products Limited aroused great interest in both the plastics and refrigeration industries when they opened last year the only plant outside the U.S. to produce expanded polystyrene by a continuous process. The new plant is capable of turning out over 4,000 c.ft. of moulded board a day.

The most striking property of this new material is its extreme light weight, a cubic foot weighing approximately 1 lb. This, together with its excellent thermal conductivity, has made expanded polystyrene an ideal material for use in the insulation of cold stores in which field it is competing very successfully with the more traditional materials such as cork. It has a rather lower thermal conductivity, and being a man-made product is more uniform than cork and is easier to handle than resin bonded glass fibre.



A typical apple store insulated with Styrocell expanded polystyrene erected on a fruit farm by local builders. The store is maintained at about 40° F.

A typical application of Styrocell expanded polystyrene applied to insulate the break-up room which serves cold stores totalling 825,000 c.ft., also insulated in Styrocell. Break-up room and stores are held at − 20° F.

In the manufacture of expanded polystyrene, beads of the plastic are first made expandable by impregnation with refinery gases. They are then "steamed" when the blowing agent expands the beads up to 80 times their original volume. These "pre-expanded" beads are next conveyed into a perforated mould through which steam is blown, producing sufficient softening (and further expansion) to cause the beads to fuse together into a solid block.

At present Eskimo Foods Limited have just finished building a cold store at Grimsby which, when complete, will be one of the largest in the country and "Styrocell" expanded polystyrene is being used as the thermal insulant. Other applications in the refrigeration industry include road and rail containers, refrigerated shop counters, ships and lagging for refrigerated pipes, in all of which the low water vapour transmission properties and ease of fixing are important features.

Economically, expanded polystyrene is the cheapest rigid ow temperature insulation material available and at current prices it costs approximately 6¼d. to obtain a conductivity of 0·22—0·25 B.t.u. per hour/per square foot/per degree Fahrenheit for one inch thickness.

Expanded polystyrene can be made to adhere to any surface without difficulty and possibly the two best adhesives for this purpose are a low-melt bitumen applied hot and a light alcohol/resin type applied cold.

As previously mentioned Styrene Products Limited and their associates, Shell Chemical Company, have, in addition to "Styrocell," continued to supply the refrigeration industry with a full range of "conventional" polystyrene moulding powders including special grades for conversion to sheet for vacuum forming.

*Styrene Products Limited, an associate of Shell Chemical Co. Limited.

Plastics in the Domestic Refrigerator Field

By J. S. HARDING, Ph.D., A.R.C.S. *

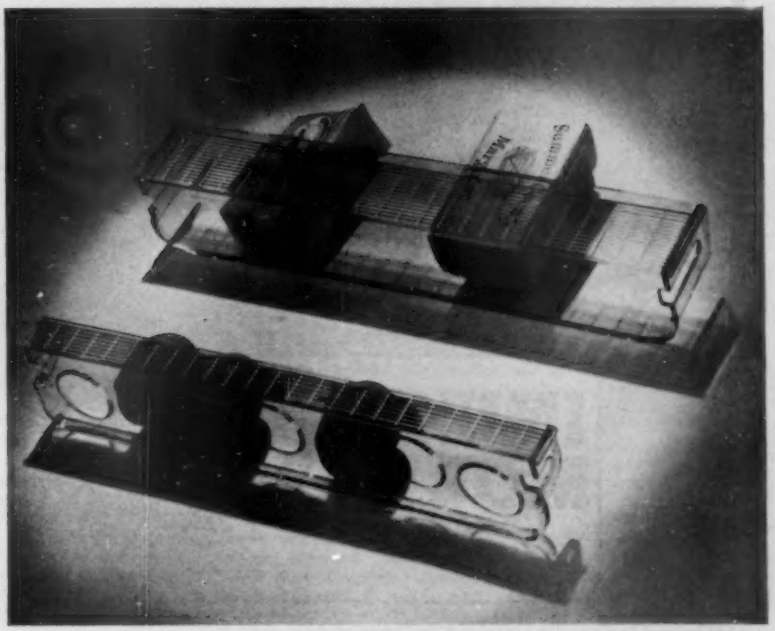
THE use of plastics in domestic refrigeration is now almost commonplace, so much have the advantages of these materials been appreciated by designers and engineers. Coupled with their ease of manipulation is the almost limitless colour range possible and the low cost of most plastics materials.

The average domestic refrigerator made in the United Kingdom may contain up to 10 or 11 lb. of plastics materials, the large majority of which are thermoplastics. In commercial refrigeration, too, plastics are being used increasingly. Perhaps the biggest advance is the use of foamed polystyrene instead of cork as an insulant in cold stores.

It is most convenient to consider the individual materials and their applications separately.

Polystyrene

The refrigeration industry provides the largest single outlet for the thermoplastic polystyrene, 4,000 tons being used in 1957 and at least 4,600 tons in 1958. In the United States



Refrigerator fittings moulded in Monsanto's Lustrex polystyrene by Streetly Manufacturing Co. Limited for Electrolux Limited.

*Monsanto Chemicals Ltd.

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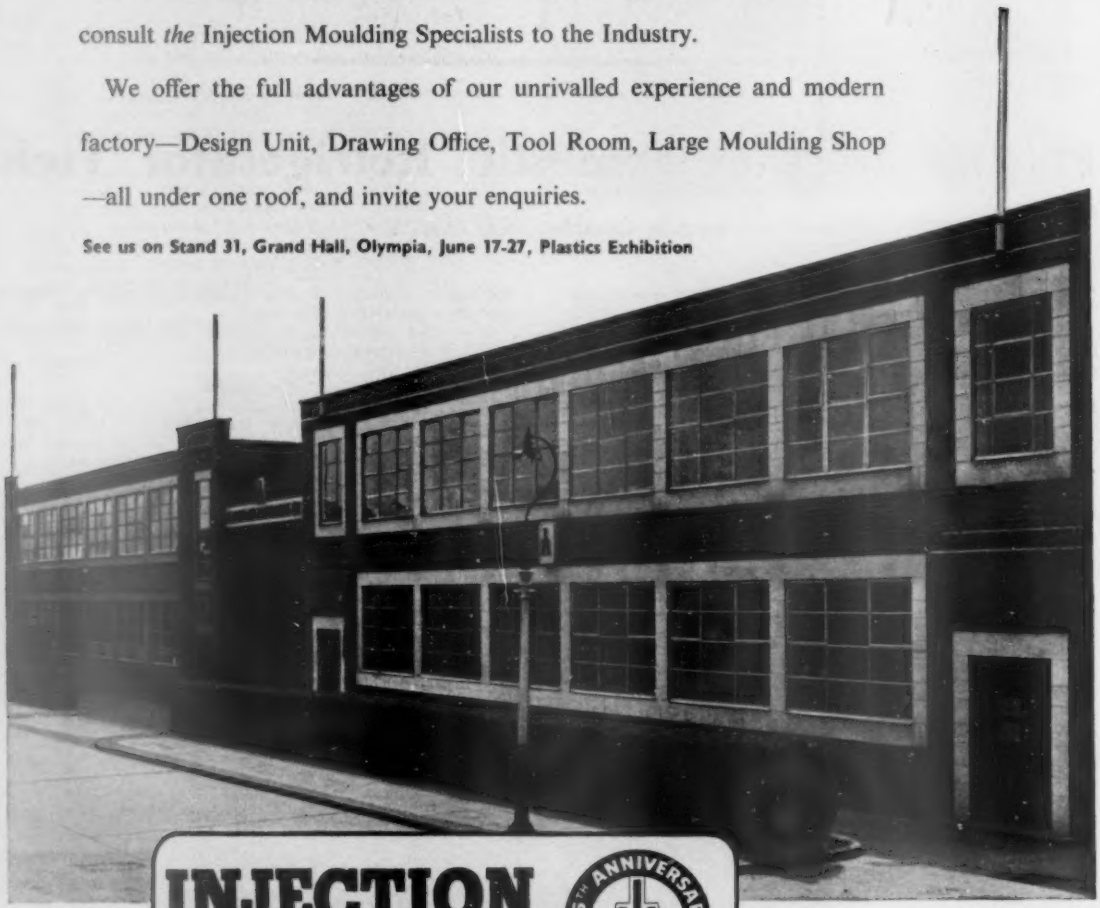

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30,000 tons or 16 per cent of the domestic usage was consumed in refrigeration in 1958. These large figures result from polystyrene's freedom from odour and taste, unimpared strength at low temperatures, excellent electrical and thermal insulation properties, dimensional stability and low water absorption. Polystyrene constitutes at least 90 per cent. of the plastics used in domestic refrigeration.

G.P. Polystyrene

General purpose polystyrene is basically water white which makes possible an unlimited range of colours and matching with enamels and anodised metals is facilitated. Drip trays, crisper dishes, freezer doors and door shelves are readily produced by the injection moulding process in a single operation whereas several stages would be required for production of similar articles in metal. Trim or breaker strips can be moulded as a complete frame or in sections. The general purpose grades of polystyrene are gradually being displaced by the rubber modified toughened polystyrenes except where transparency is required. A good gloss is obtainable with these materials and with their greater strength they give rise to components which are much better able to withstand rough handling during construction or repairs. They are used in some door latches. The most significant development is the use of toughened polystyrene for the injection moulding of a complete refrigerator inner liner, as reported in the March edition of MODERN REFRIGERATION. This moulding weighs over six pounds and is the largest injection moulding currently produced in this country. Toughened polystyrene liners have been produced in the past by vacuum forming of toughened polystyrene sheet which is manufactured by extrusion. The advantage of the moulding process is that variation of the thickness of the articles can be obtained where required, and little or no finishing is required, although the mould costs are approximately 10 times greater than for the forming process and modification in design are not easily achieved. The forming process and the development of toughened polystyrene sheet have resulted in at least 60 per cent. of the United Kingdom domestic refrigerators now being produced having toughened polystyrene inner liners and the great majority using this material for door liners. One model has a combined inner liner and outer case produced in one vacuum-forming operation.

Another application for toughened polystyrene sheet is in the production of thin-walled containers by vacuum forming of 0·01 in. thick sheet. Packs for deep frozen food and ice-cream can be made in this way.

The third form in which polystyrene is used is in expanded polystyrene. This rigid white foamed material is an excellent thermal insulator (k values as low as 0·22) and can be obtained in the form of blocks with a density as low as one pound per cubic foot. Having a closed cell structure there are few problems of condensation. It is readily manipulated for insulation of both domestic refrigerators and cold stores, and in the latter its strength enables it to be used for structural purposes. It is unattacked by vermin and is steadily replacing cork for commercial installations. It is possible that sandwich structures using this material between sheets of toughened polystyrene may form the basis for new designs of refrigerator cabinets, in particular those intended to be built into walls or cupboards. The first steps in this direction have already been taken in the United States.

Polyethylene

This versatile material which has been widely used in housewares and cable industry also finds applications in the refrigeration field.

In the form of film it is used for wrapping deep frozen foods as it is free from taste and odour, and unaffected by moisture and grease. In the form of injection mouldings its strength and flexibility make it ideal for ice cube separators. It is also used for moulded gaskets for the joint between the inner liner and the evaporator unit in domestic refrigerators. Polyethylene in powder form is used for coating metal articles such as wire shelves and trays to give a coherent protective coating.

Polyvinyl Chloride (P.V.C.)

Extruded sections of plasticised P.V.C., are generally used for flexible door gaskets in domestic units. Sheets of extruded or pressed rigid P.V.C. have been vacuum formed into door and inner liners but in domestic refrigerators has given way to toughened polystyrene owing to the lower density and price, and easier manipulation of the latter material. In commercial refrigeration, however, the greater impact strength of P.V.C. over polystyrene is of importance and rigid P.V.C. is used to line cold rooms and display cabinets. Its resistance to corrosion and general chemical resistance is of particular value on board ship. The newly developed P.V.C. coated steel known as Stelvetite may have similar applications.

P.V.C. is widely used for cable and wire insulation where its strength, electrical and chemical resistance are of importance.

Nylon

The great strength and low frictional co-efficient with most materials make the various nylon materials ideal for hinge and latch components where abrasion is a problem with other materials. The largest single application at present is for a complete door handle where strength is paramount. Nylon powder is also used for the protective coating of metal articles where greater resistance to abrasion or heat is required than can be given by P.V.C. or polyethylene.

Space does not permit a more detailed discussion but mention should also be made of melamine resins which are used in production of the decorative laminates incorporated into the working tops of some domestic units and commercial display cabinets, and of the polyisocyanates or polyurethanes as they are also known. These materials can be used to produce foamed insulation *in situ* in places which would be difficult to fill by any other means. Their chemical resistance is excellent and the foam can be made to adhere to metal and other surfaces.

Yet another application of plastics lies in the use of epoxide resins in resin based paints used as primers and for coating of shelves. Stove enamels based on epoxide resins have a superior chemical resistance to alkyd based enamels, and their adhesion to most surfaces is outstanding.

In conclusion, it is not difficult to visualise the production of a domestic refrigerator in the not too distant future of which all components are of one plastics material or another with the exception of the actual refrigeration unit. The future progress of the refrigeration industry will certainly be strongly influenced by new developments in both the processing technique and materials of the plastics industry.

A New Material for Refrigerator Liners and Components

M & B Plastics Ltd. are introducing a new thermoplastic sheeting to the British market which is proving of great interest to the refrigeration and allied industries. This new product, "Rhovilene," a vinyl chloride/vinyl acetate copolymer sheet, is produced by the extrusion process. This fully extruded (non-laminated) sheet possesses several outstanding advantages: it is durable, has good dimensional stability and exceptionally good ageing properties. Moreover, because it is an extruded sheet the manufacturers have greater control on thickness tolerances.

"Rhovilene" can be produced in thicknesses from 0·016 in. and in widths up to 40½ in. A large number of combinations of sheet sizes and thicknesses can therefore be offered.

The resilience and high impact strength of this new plastic material permit a wide range of working conditions with excellent results. For example, it can be sheared with strong scissors, clicking press, or guillotine, or sawed at high speed;

Courtesy Stearne (L.) & Co. Ltd.

Courtesy Marco Refrigerators Ltd.

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JABLITE, the most up-to-date and hygienic insulant is used for commercial refrigerators, refrigerated display cabinets, cold stores, cold rooms, refrigerated rail and road vehicles. Also for transit containers for fish, ice cream, frozen foods, dry ice, chemicals etc.

Leading manufacturers have JABLITE in common.

Courtesy Hussmann British Refrigeration

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We are the largest manufacturers of expanded plastics, P.V.C. and polystyrene insulation material
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it can be vacuum formed, compression moulded, embossed and welded. In moulding operations, " Rhovilene " should be heated to a temperature of approximately 90°C. The material will then become soft and flexible, suitable for shaping into a variety of different forms. Excellent mouldings are achieved without risk of tearing even when complicated shapes and sharp angles are made.

Heating is not necessary in the case of some metal working techniques such as folding the sheet edges into right-angle bends. Where necessary, self-tapping screws may be employed.

Because of its ease of forming and moulding. " Rhovilene " is eminently suitable for the manufacture of refrigerator components in addition to liners : crisper trays and freezer trays, for example, and shelves for fixing on the door liners themselves. There is also the additional advantage of reducing tooling costs.

There are six finishes, including unpolished and varying degrees of polishing and matting on one of both sides. The press polished finish has a mirror-like surface. In every finish there are several colours available including some attractive pastel shades of blue, yellow, red, and grey. It is understood that the manufacturers will endeavour to match specified colours.

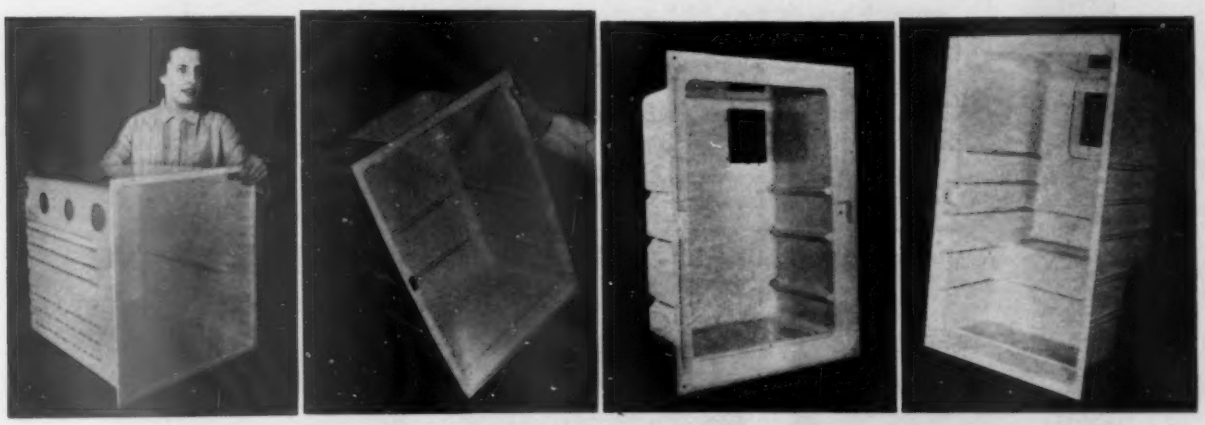
" Rhovilene " is resistant to acids, bases and the following chemicals : carbon tetrachloride, methyl and ethyl alcohol and ether. It is also resistant to vegetable and mineral oils, commercial detergents and chlorine water. The low thermal conductivity of " Rhovilene " eliminates the need for manufacturing separate breaker strips for fitting on the liners. These can be incorporated as an integral part of the liner.

Owing to its exceptional ease of forming, combined with its excellent strength and durability, " Rhovilene " is an ideal material for the manufacture of refrigerator components for both commercial and domestic use including the production of integral liners and cabinet exteriors in a single moulding operation. It is odourless and is pleasant to the touch.

Saroy High Impact Polystyrene Sheet in Modern Refrigeration

By J. P. GEOGHEGAN •

WHEN Saro Laminated Wood Products Limited extended their plastics division in 1956 to include the production of Saroy high impact polystyrene sheet we envisaged that one of the main consumers would be the refrigeration industry. Polystyrene components, manufactured by the thermo-forming process, have replaced metal parts due to their inherent good properties such as lightness in weight, self coloration and, therefore, freedom from finishing operations and resistance to corrosion. High impact polystyrene sheet has become the most popular material in refrigeration due to its durability, pleasing appearance and the ease with which new designs can be economically produced. To-day, one has only to analyse the number of refrigeration companies in the United Kingdom and overseas who have redesigned their models by incorporating polystyrene inner cabinets and door liners to appreciate their confidence in this material.



Various types of refrigerator cabinet liners made from Saroy polystyrene sheet.

We foresaw the expansion of polystyrene sheet in this large industry and met its increasing demands by installing additional plant. We now have six large capacity extruding machines, each capable of producing sheet in thickness from 0·010 in. to 0·250 in. and in size up to 48 in. wide by 100 in. long.

There is a range of high impact polystyrene materials available and as general extruders it is our policy to carry out detailed development and research programmes into each

•Sales Manager, Saro Laminated Wood Products Limited.

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'RHOVILENE'

trade mark *brand*

RIGID VINYL COPOLYMER SHEETING

A NEW material for refrigerator components.
IDEAL for liners and door panels. The large sheet sizes available make 'RHOVILENE' the material of choice for panelling.

'RHOVILENE' is a fully extruded (non-laminated) sheet possessing excellent deep-drawing qualities and high impact strength permitting the production of integral liners and cabinet exteriors in a single moulding operation.

* in widths up to 40″ and lengths up to 120″
* in several finishes and attractive colours

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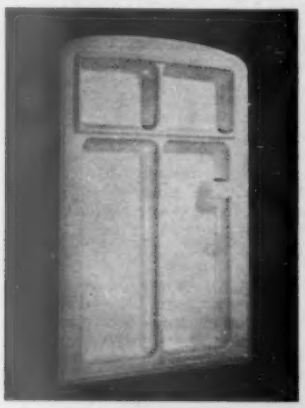
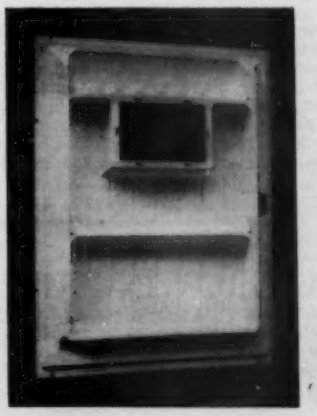
formulation. Only when we are satisfied that the material will yield sheet to a stringent specification laid down for Saroy is it offered to the industry.

To meet this specification our chemical and physical laboratories carry out a series of tests including impact strength which is recorded as the energy level, at which 50 per cent. of a large group of specimens would fail, tensile strength and elongation at break of Saroy sheet and areal elongation to determine that the pigment dispersion is adequate and the material void free. Further tests ensure that the degree of reversion is the optimum for the application for which the sheet is to be used. Detailed running conditions are laid down and the sheet finally tested on a vacuum forming machine specially installed in the laboratories for this purpose. Our control laboratories are situated in the extrusion shops and it is their responsibility to see that the specified running conditions are maintained and that samples of sheet are taken from production runs for testing and checked for surface finish, gauge control and quality.



Door liners made for the refrigerator industry from Saroy polystyrene sheet.



PLASTICS IN REFRIGERATION

As a result of this extensive development work and quality control, Saroy sheet can be produced with a range of properties which are related to the article to be formed and the forming machine. Considerable importance is attached to these properties since we are extruding Saroy sheet that will be vacuum formed for inner cabinets and door liners for many of the leading refrigerator manufacturers. Door liners are

Conservator lid made from polystyrene

normally formed from sheet in gauges from 0·050 in. to 0·080 in. and although the draw is relatively shallow, designs can be quite complex. The photographs of the door liners illustrate not only the formability of Saroy but the excellent designs made possible by the vacuum forming techniques. It was not long before it was realised by the refrigeration industry that both economically and design-wise polystyrene was the ideal material for inner cabinets and a greater part of our development work has been concentrated on producing the necessary properties in Saroy sheet that will enable deeper and more complex formings to be made. The photographs show a few of the inner cabinets formed from 0·140 in. and 0·180 in. Saroy and also illustrate the importance of co-ordination of good sheet extrusion with well planned designs and correct forming techniques. Regarding design, it is important to appreciate that to obtain the most benefit, both technically and economically, from the use of thermoplastic sheet, the components we have been discussing should be designed to suit the physical properties of the material and formed so that that they are completely free from stress concentrations. They should be mounted in structures which are themselves rigid and self-supporting.

The development of vacuum forming machines has kept pace with the progress in sheet extrusion and the advances in refrigeration design and to-day there are a number of excellent machines capable of forming deep and complicated draws. Close co-operation exists between the manufacturers and ourselves and Saro's technical sales personnel have made a detailed study of vacuum forming and are, therefore, available, if required, to advise on the forming of Saroy sheet irrespective of whether " vacuum," " drape," " air slip " or " plug assist " techniques are used.

A number of refrigerator components in addition to those mentioned are being formed from Saroy sheet and include evaporator containers, crispers, trays and surrounds and night covers for frozen food cabinets. Many models waiting to be restyled will incorporate polystyrene and a far larger proportion of inner cabinets will be vacuum formed. The trend, whether due to improvements in design, reduction in purchase tax, availability of bank loans or a higher standard of living, indicates a very large increase in refrigerator production. No longer are refrigerators a luxury. Sound design, and simplified production techniques involving the use of thermoplastic sheet have enabled a wide range of models to be manufactured to cover the demands of every income group.

Durable Plastics Ltd. are Specialists in Wire Covering

ANOTHER fast growing outlet for plastics in refrigeration is their use as a coating on wire shelves. The plastic principally used for this finish is low density polythene.

It might be said : " Why use a plastic ? What is wrong with the existing conventional finishes such as bright tin dip or stove enamel paint ? " The main fault of both these finishes is that they are relatively thin, in the 2-3 thou. range, which means that pin-holing is inevitable at the sharp points of the wires and at undercuts. At the same time, even the best hot dipped tin finish rusts and discolours within a comparatively short period of time, and top quality stove enamel finish is very often scraped, particularly at the points of wear on the front of the shelf, where it allows rust to develop.

Polythene coating, however, completely overcomes these faults — the average coating is at least 10-15 thou. thick and completely swamps the joints and leaves a heavy coating over the ends of the cropped wires, thus obviating any risk of rust.

The coating, as undertaken by Durable Plastics Ltd. of Guildford, can be supplied in a full range of colours—even if it is accidentally scraped the self colour still maintains the over-all appearance. At the same time such a coating reduces the nasty " clonk " associated with placing glass bottles onto a thinly coated wire shelf.

Recent advances in techniques have substantially reduced the cost of plastic coating and it is now becoming very competitive with top quality stove enamelling.

English Electric, Pressed Steel, Astral and Lec are widely using these finishes, and it is used on specialist models by Frigidaire, Kelvinator, Aero Pipe & Glass, among others.

Advances can also be expected in the use of p.v.c. sprayed coatings, on the steel liners of refrigerators. Here care has to be taken to get the correct formulation to prevent tainting and toxicity, but this if fairly easily overcome.

Sprayed p.v.c. liners have a promising future as they offer the strength and rigidity of steel, combined with the cleanliness, durability and attractive appearance of plastics.

THE GROWING USE OF " PORON "

" Poron " is a closed air cell, rigid, insulation material which has come to the fore in recent years. It is produced by expanding polystyrene approximately 40 times. The product consists of about 98 per cent. still air. The raw material polystyrene, which forms the extremely thin fused cell walls, is water proof, and so " Poron " retains its high moisture resistance under all conditions, even the most humid. This property is not affected or diminished by age or continuous use. Apart from its low

Left: Insulating a display case with "Poron." Above: Applying "Poron" sections to a cold store.

thermal conductivity, "Poron" is most effective for sound insulation of floors, partitions and walls, etc. It can be supplied in the form of special acoustic panels.

"Poron" is resistant to sea-water, brine, alcohol, alkalis and all acids, with the exception of concentrated nitric acid. The material is odourless and does not absorb odours. It is rot-proof and resistant to mould and decay. It does not provide any sustenance for vermin, insects and termites and can be supplied in standard form or flame-proofed. It is snow white in appearance, and can be cut, sawn, drilled or fixed with adhesives. Thin sheets of "Poron" are quite flexible and therefore easy to erect. It does not delaminate, flake, dust or irritate the skin.

The high insulation efficiency of "Poron" allows the use of a much thinner layer of insulation material, with consequent saving of space.

In all applications "Poron" expanded polystyrene fully maintains its high standard of quality and efficiency.

"Poron" which is manufactured by Commerce Factors (G.B.) Ltd. Torpoint, Cornwall, provides an efficient insulating material for cold rooms, deep-freeze stores, domestic refrigerators, refrigerated containers, refrigerated vehicles and trucks, refrigerated counters.

UNION CARBIDE TO DOUBLE POLYETHYLENE PRODUCTION

Plans for doubling Union Carbide's polyethylene production in the United Kingdom were announced recently by Thomas F. W. Jackson, chairman of Union Carbide Ltd. Existing facilities at Grangemouth, Scotland will be augmented by another unit scheduled to produce 30,000,000 lb. weight annually. It is anticipated that the new unit will be in production by late 1960. Bakelite Ltd., an affiliate of Union Carbide Ltd., long a major supplier of plastics materials in the U.K., will distribute the output of the plant. In addition to the initial polyethylene plant at Grangemouth, Union Carbide Ltd. is constructing an ethylene oxide and derivatives plant at Fawley, Hampshire, which is expected to be in operation in the last quarter of this year, with a production capacity of 45,000,000 lb. annually. This latest expansion represents the sixth major investment by Union Carbide Corporation in the European petrochemicals field. S.P.A. Celene, a jointly owned Italian company formed in 1957 by Union Carbide and Societa Edison of Milan, is constructing a polyethylene unit as well as an ethylene oxide and derivatives plant in Sicily. Both installations are expected to be in production in 1960. In Belgium, another polyethylene plant of approximately 30,000,000 lb. annual capacity, a joint venture of Union Carbide and the Belgian company Société Chimique Des Derives Du Petrole, S.A., was announced in January of this year.

NEW APPLICATION OF "STELVETITE"

Stelvetite, the plastic-coated steel sheet produced by John Summers & Sons Ltd., Shotton, Chester, is now being used in the manufacture of frozen food cabinets. First application in this field is by the Aero Pipe & Glass Co. Ltd., Harlesden Road, N.W.10, who are using shelf-length Stelvetite to protect and shield the fluorescent lighting. The company plan to follow this initial use with Stelvetite shelving, and possibly other applications. Stelvetite was chosen by the company because of its strength and attractive finish which will not mark, even when subjected to heavy knocks.

URETHANE FOAMS FOR INSULATION

By J. M. BUIST, B.Sc., F.I.R.I., F.Inst.P.*

Introduction

URETHANE foams, which have only comparatively recently become of industrial significance, depend for their production on reacting suitable chemicals together in such a way that carbon dioxide is released to form a foam at the same time as other chemical reactions are taking place to crosslink the polymer and fix its final shape. Isocyanates are the key chemicals in these processes since they react with water to produce carbon dioxide and also react with hydroxyl groups in esters and ethers for crosslinking.

Fig. 1.

The reaction of the isocyanate with water is exothermic and releases carbon dioxide in situ and this gas foams the urethane whilst the heat generated accelerates the crosslinking or cure. Polyester or polyether resins can be chosen so that the foam produced is either flexible, rigid, or semi-rigid. The flexible varieties are being used in mattresses, cushions, seat squabs and pillows, and combined with textiles for insulation purposes. The rigid foams, which are being employed as insulants in refrigerated ships and in land cold stores, have surprisingly high structural strength and bond strongly to metals and other materials. These properties enable rigid foams to be used as the cores in the making of lightweight laminates.

Special machines have been developed for the production of both flexible and rigid urethane foam, and with such machines it is possible to produce foams of very low density. In the case of flexible foam, densities of 1½ lb. per c.ft. are being made for packaging, whereas densities of 2–2½ lb. per c.ft. are made for applications where greater load-bearing strength is required. In the case of rigid foams, the lower limit on density of machine-made foam at present is about 2–2·25 lb. per c.ft. although this limit will be undoubtedly lowered as newer chemicals now under development become available. It has been a notable achievement to develop both suitable chemicals and machines to enable a chemical process to be carried out at the site of operations.

Thermal Insulation

The increasing demand for thermal insulation in industry has encouraged the development of a considerable range of products designed for insulation purposes. The problems of completely filling hollow walls, floors and ceilings or of covering pipes, tanks or other vessels for industrial or domestic use are considerable. For efficient insulation the circulation of air in the medium must be reduced and eliminated as far as possible. Since air is one of the most efficient insulators as long as it is kept in place and not allowed to circulate, it is natural that foam materials in which the air is contained in closed cells should make very satisfactory insulants. Some of the desirable properties which have to be considered when choosing an insulant to meet the conditions of both refrigeration and high temperature insulation are—low water absorption, low density, resistance to settling, resistance to fire, low thermal conductivity, resistance to rotting and odour, low thermal capacity, good compressive strength, adequate maintenance of these properties at the temperatures of operation, and, of course, price. Other factors which also have to be considered are ease of installation, ease of maintenance, and cleanliness. In both low temperature and high temperature insulation the economic insulation thickness has to be determined ; if this is judged to be the point where the cost of insulation added to the cost of heat lost is at a minimum, the factors which have to be considered are the quantity of heat lost, the hours of operation per year, the

Fig. 2.

* *Imperial Chemical Industries Ltd.*

For greater clarity—

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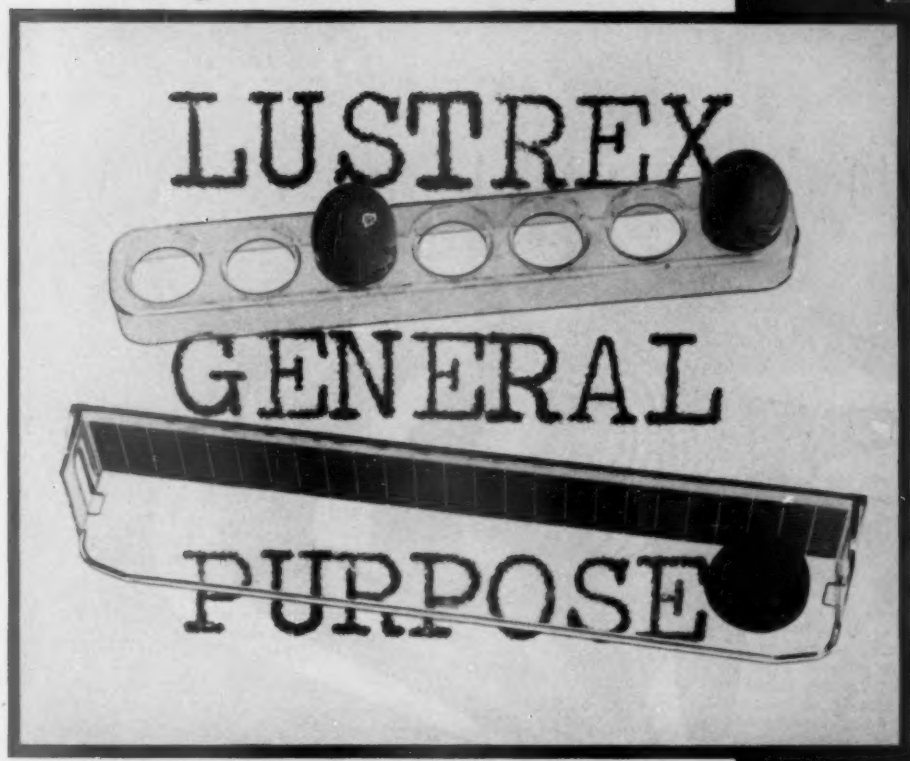

Refrigerator fittings moulded in Lustrex GP by Streetly Manufacturing Co. Ltd., for Electrolux Limited

Lustrex General Purpose, like all grades of Monsanto Lustrex, is a HIGH-QUALITY polystyrene. This and its special advantage of high clarity—now further improved—make it the ideal polystyrene for producing top-class, transparent mouldings. That's why you should always insist on Lustrex General Purpose—for sparkling, crystal-clear refrigerator fittings.

- Lustrex General Purpose is also available in a wide range of standard colours ; or, special colours can be accurately matched within a few days.
- There is a grade of Lustrex for every job in polystyrene.

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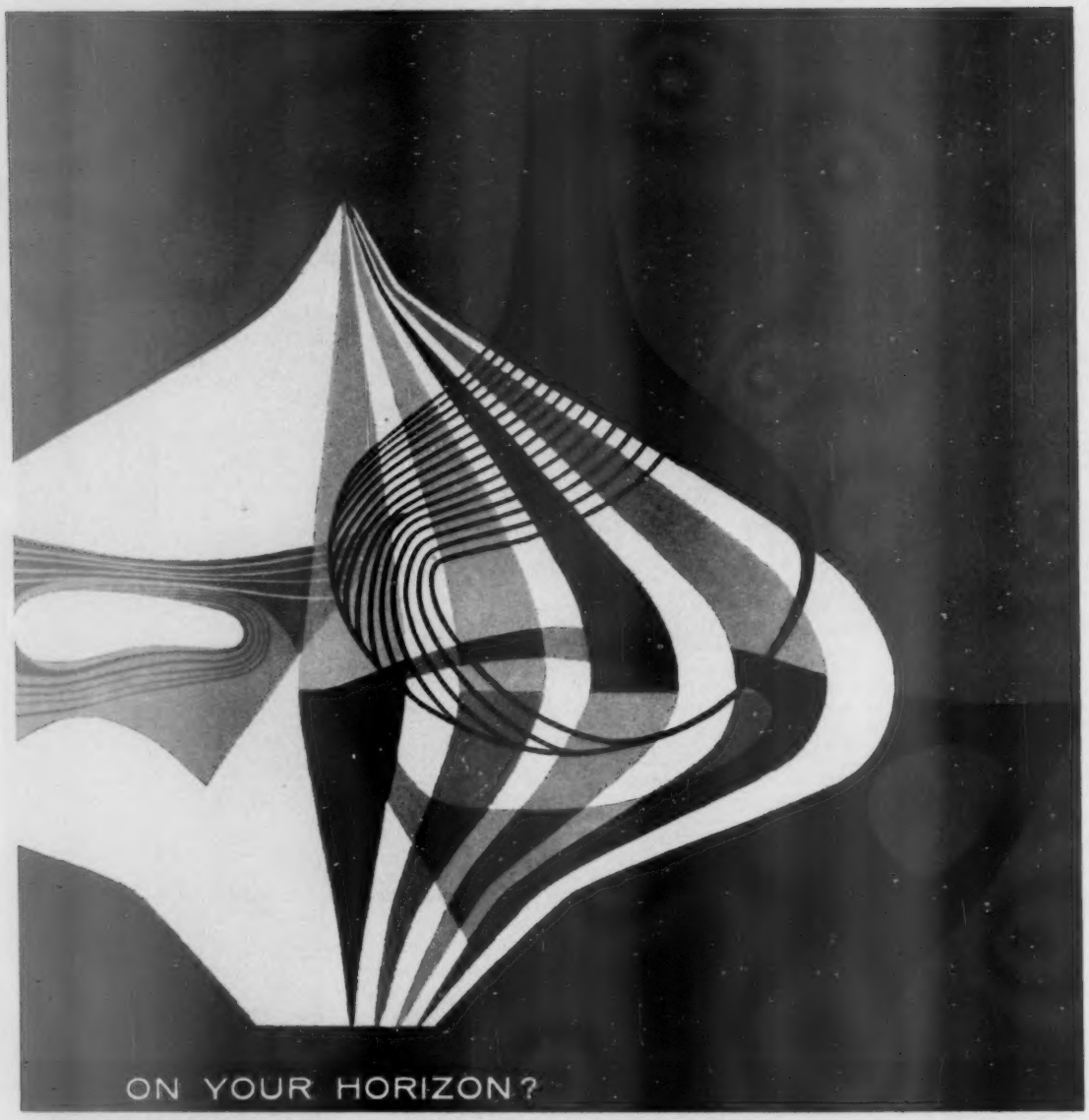

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At this moment, on a drawing board somewhere, is a design which could mean an entirely new product. It could be a product for either light or heavy industry: for instance, toys or electronics, household appliances or chemicals. But whatever the field, when the time comes for bulk manufacture, there are powerful reasons—mechanical, chemical, dielectric and economic—for believing that the material chosen will be high impact polystyrene.

When that happens it will not be just happy chance if the selected brand of polystyrene is Iridon. Iridon Limited have the resources and the experience to meet the demands of every new development the moment it becomes a mass market proposition. Iridon Limited are constantly perfecting new techniques, new processes; constantly exploring the immense possibilities in plastics — always with the aim of fitting them for the ever-changing pattern of industry.

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cost of heat, the cost of installation of insulation, the cost of maintenance, and the period of depreciation. The basic information required by insulation engineers to enable them to assess the value of urethane foams is available now, and an ever-increasing collection of service data is being accumulated.

Flexible Foam

Trials made in factories within the dyestuffs division of Imperial Chemical Industries Limited have shown that several installations made two years ago are giving excellent performance. A typical installation is shown in fig. 1 where preformed flexible foam in the form of a tube with a longitudinal split has been used to cover piping and flanges have been boxed by building up the outside diameter of the pipe on either side of the flange to the outside diameter of the flange and fitting a short sleeve around the outside diameter of the flange and the " built-up " pipe. The urethane flexible foam is light and clean to handle and can be supplied with a sealing skin of P.V.C. film on one or both surfaces. The foam can be easily stuck to most materials, including itself, by means of suitable adhesives. The ease with which it can be fitted after having been tailored to meet the site requirements and removed and replaced after an inspection or maintenance operation, enable installation and maintenance costs to be reduced to a minimum. Sheets of flexible foam have also been used successfully to insulate hot-water tanks ranging in size from the ordinary domestic hot-water tank to large industrial water tanks.

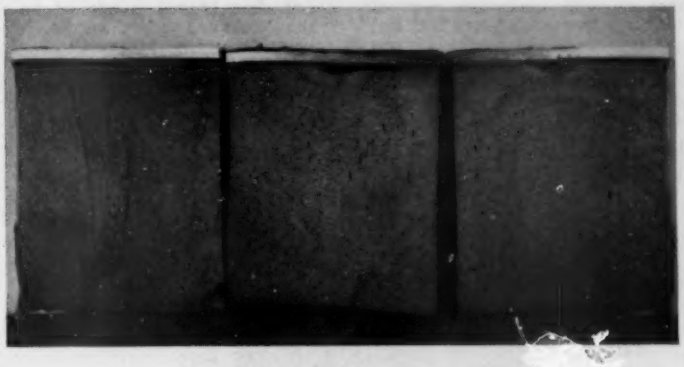

Fig. 3.

Rigid Foam

Rigid foam has also been employed in the case of industrial tanks. When foamed against metal the liquid mix expands as it foams and follows the contours of a cavity wall, ensuring an intimate contact and good adhesion between foam and shell. The final result is therefore much more integral in character than when other cellular materials are used. When foamed " in situ " a skin is formed on the outside surfaces of the foam in contact with the shell surface or exposed to air. These skins help to reduce water uptake and water vapour transmission. When foamed against metal these skins are bonded to the metal surface and it has been found that rigid urethane foams contribute protection against corrosion. The nature of the chemical reaction whereby the isocyanate will react with any water on the surface of the metal undoubtedly helps, since the surface of the metal is dried and sealed in one continuous operation. Tests in which sheets of steel with a $\frac{1}{2}$ in. layer of foam on one side have been subjected to several months' continuous salt water spray and also to alternate cycles of exposure to water at room temperature and then cooling to –5°C., have shown that the steel in contact with the foam was hardly affected, while the unprotected steel showed severe corrosion. These results have proved of considerable interest to shipowners, marine insulators, etc., who hope to considerably reduce, if not eliminate, the multi-coat application of primers, such as red lead, to the bulkheads of insulated holds. These results are also of interest to those concerned with building and insulating metal parts in factories.

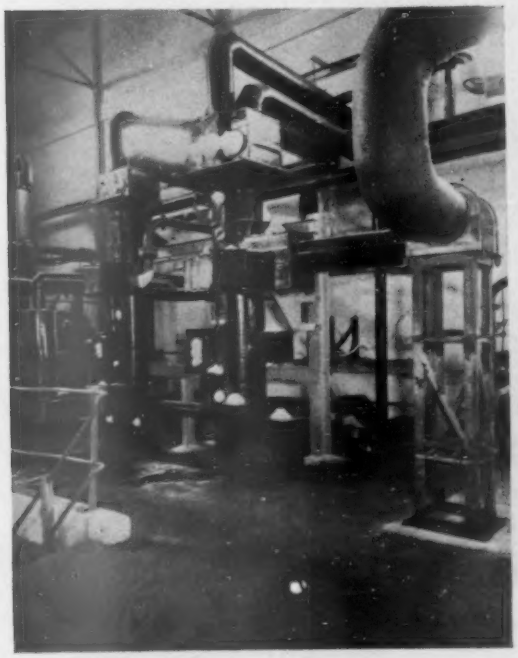

Fig. 4.

Resistance to burning is an important property of an insulation material and some fires on ships have been thought to have been started by welders working on the metal bulkheads backing onto combustible insulation. When effecting temporary repairs to exterior ships' plates that have suffered minor damage the arc welding process is liable to

cause damage or destroy the insulant in the region of the repair, and these factors normally necessitate removal of the cargo from the affected hold and stripping of the hold before repairs can be carried out. In the case of rigid urethane foam some interesting small scale laboratory tests (see fig. 2) have suggested that there would be a negligible rise in temperature on the inner face of the insulation during welding through foam of 6 in. thickness or more. With this thickness of foam the permanent loss of insulating properties in the region of the weld would also be small (see fig. 3). These results should encourage and stimulate larger scale trials.

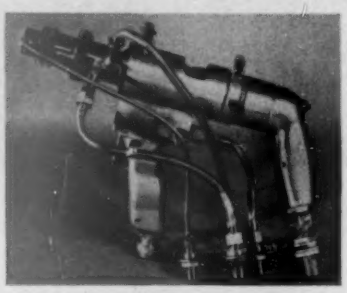

Fig. 5.

Site installations within Imperial Chemical Industries Limited's factories with rigid urethane foam have shown that many types of structure can be insulated at a much greater speed by the in situ foaming technique. This speed of operation is of importance for reasons other than reducing labour costs. For example, at the Imperial Chemical Industries Limited's Hillhouse factory a section of a carbon dioxide plant (fig. 4) was insulated with urethane rigid foam rather than cork because it was desirable to reduce the shut-down time on the plant. Another example from bulk experience concerned the insulation of a header tank at a cold store which was insulated in two days, whereas the contractor estimated that it would have taken 2 to 3 weeks by conventional techniques.

The number of ships with refrigerated cargo space has increased progressively since the start of this century, and in 1957 there were 2,500 ships with a capacity of 180,000,000 c.ft. of refrigerated cargo space*. Up to the present there has been no standard for the thickness of insulation since insulation requirements of owners who have successfully operated refrigerated ships over long periods differ. The thickness of insulation varies, but H. R. Howells of Lloyd's Register of Shipping* has stated that in the case of spaces intended for maintaining 15°F. through tropical waters, insulation to a depth of 6 to 8 in. is applied on the tank tops and on top of decks where the space below is not refrigerated, 8 in. (or 1½ in. to 2 in. greater than the depth of the frames and deck beams) is applied on the ships' sides and under the decks. When lower temperatures have to be maintained a greater thickness of insulation is required. It has been estimated that 1 in. of insulation on all insulated surfaces could mean the loss of over 100 tons of cargo space on a large refrigerated ship.

In certain areas of ships it is not possible to reduce the thickness of insulation used because of the presence of stiffeners but reduced thickness could possibly be used on certain areas of the bulkhead and deckhead if a satisfactory insulant is used. Clearly the economic urge to save space is great, particularly when the shipbuilding industry in the United Kingdom is facing increasing and serious competition from Germany and Japan. Both owners and insulating companies are concerned that improved insulants and methods of placing insulants should be developed, and fortunately the chemical industry has provided a possible way of achieving both these desirable objects.

The lower density of rigid urethane foams also contributes to a saving in the weight of insulant carried, and because of its high structural strength enables lightweight laminated doors and hatch plugs to be fabricated. The saving in weight can be illustrated by a food store door which weighed 330 lb. when made of timber but only 109 lb. when laminated with rigid urethane foam. The use of these lightweight doors is extending on board ship, in railway carriages, public transport and offices, and some ships are fitting about 250 such doors. Laminated decking incorporating rigid urethane foam is also being manufactured in this country. With rising fuel costs the appreciable savings in dead weight carried on board ship that can therefore be made are of great importance to all concerned with reducing running costs.

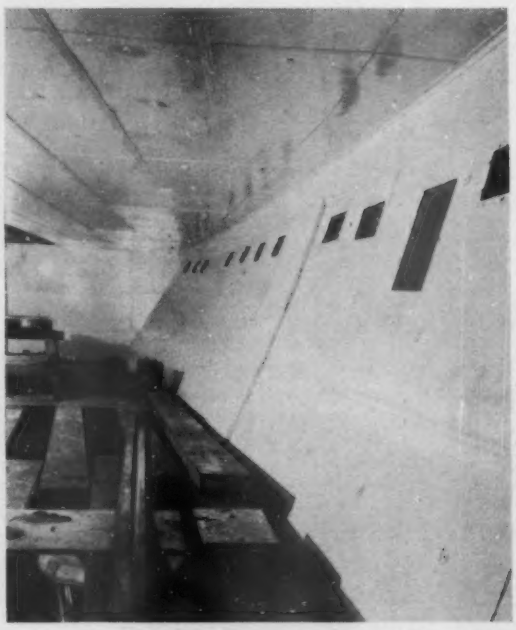

Fig. 6.—"Ionic" at Cammel Laird's shipyard, Birkenhead. General view of the completed ship's side, forward bulk-head and section of deck-head.

polystyrene for refrigerator components

Erinoid grades of polystyrene are ideally suited to low temperature applications. For example, Erinoid CP.20 grade is a high impact polystyrene which has excellent flexural strength and exhibits high elongation coupled with good tensile strength. It is easily processed by injection moulding, giving a fast rate of production with a high-gloss surface finish. Then there is KLP general purpose grade—easy flowing and ideal for transparent mouldings.

This is the new Electrolux model L.26 refrigerator. The ice compartment and the drip tray are in Erinoid CP.20, the door shelves are in Erinoid KLP transparent blue.

Exhibitors at
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Erinoid *polystyrene is manufactured by*

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Complete liners—neat, clean and original—can now be vacuum formed in Styron; their impact strength is high, their low temperature behaviour impeccable. No matter how distinctive the design, it can be achieved economically with Styron. For liners, breaker strips, trims, trays and boxes, in refrigerators that enhance the contemporary kitchen scene.

For full information about Styron, please write for Booklet No. 211

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BRP SALES AND TECHNICAL SERVICE DEVONSHIRE HOUSE PICCADILLY LONDON W1 HYDE PARK 0151

Spray Process

Urethane rigid foams can also be applied by a spray process (see fig. 5). This development is of great potential interest both for new and existing buildings since layers of sprayed foam can be applied to the under surface of roofs. This is of particular interest in buildings covered by the Thermal Insulation (Industrial Buildings) Regulations, 1958. The technique is also of interest for those buildings, at present exempt from these regulations, which are heated solely by a manufacturing or cleansing process carried on inside them, since, by spraying various parts, a reduction of heat loss can be obtained thereby leading to a saving of fuel. For example, the insulation of certain types of pipes, valves, etc., will become a simpler matter by means of the spraying technique. The stocking of a great variety of moulded sections will be avoided, and greater efficiency can be expected from valve insulation carried out by spray technique. In addition, sprayed foam can be used where labour costs would prevent the use of sheets of insulant, for example in the anti-drumming treatment and heat insulation of air-conditioning ducts. With the Imperial Chemical Industries spray unit, a layer of foam can be applied up to $\frac{3}{4}$-in. thick at the rate of 24 sq. ft. per minute, the density of the foam being in the range 3 to 4 lb. c.ft. It is confidently expected that rapid progress on the full commercial scale will take place over the next year or two.

Data that are being obtained from heat balance tests carried out on holds of ships where urethane foam has been employed (fig. 6) confirm that the material is an excellent insulator. These new materials and techniques therefore provide an opportunity to improve the efficiency of equipment, by providing better insulation and ease of installation, and decreasing the need for maintenance because of the high corrosion protection and excellent ageing of urethane foams over a wide temperature range. These factors, along with the many other interesting properties of urethane foams, should encourage many industries, including the refrigeration industry, to study closely the application of these materials in new installations in order to improve overall efficiency.

*H. R. Howells. Marine Refrigeration. 31st Thomas Lowe Gray Lecture delivered to Institution of Mechanical Engineers, London, 23rd January, 1959.

Progress in Expanded Polystyrene

By A. G. OWEN*

DURING the last two or three years no insulation material has excited as much comment or controversy as has expanded polystyrene. It has been hailed, quite erroneously, by some, as a new and universal panacea for all the complaints which beset the insulation industry; it has been condemned, equally erroneously by others, as an untried material of suspect stability and variable physical properties. The answer, like most answers, lies between the extremes of view.

Since its inception in 1925, Expanded Rubber Co. Ltd. has been pioneering the production and application of expanded, closed cell materials and it is therefore to be expected that the first expanded polystyrene in this country was manufactured by ourselves. In 1943 we took out the first British patent on expanded polystyrene, registered it under the trade name of Polyzote, and formed Expanded Plastics Ltd. as a wholly-owned subsidiary of Expanded Rubber Company. Today, 16 years later this patent remains the only entirely British process for expanding polystyrene — a tribute to British industry in the face of strong Continental opposition. Subsequent co-operation with our associates B.X. Plastics Ltd. has enabled us to maintain this initial lead.

Yeats once said that his own achievements in literature had given him the right to be dogmatic about other people's. Being rather more deferential we submit that our researches and contracting experience enable us to temper enthusiasm with objectivity and to view expanded polystyrene, not as the only all-purpose insulant but as a material complementary to other insulants, better for some applications, not as good for others.

In heavier densities, expanded polystyrene shows remarkable qualities as a low temperature insulation and at 2 lb. a c. ft. its conductivity reaches an optimum efficiency of 0·22 B.t.u. per sq. ft. hour °F per 1 in. thick at a mean temperature of 50°F. Above and below this density the conductivity rises. But, in order to make polystyrene on a competitive basis, the tendency has been to lower the density as much as physically possible, with resulting detriment to its characteristics. The following table may serve to illustrate this feature.

Although Polyzote can be manufactured in all the densities below, the

Expanded Polystyrene

Density lb. per c. ft.	Thermal conductivity in B.t.u. sq. ft. hr. °F. per 1 in. thick at a mean temperature of 50°F.	Water vapour transmission gm. per sq. m. 24 hr. per 51 mm. thick at 44·72 mm. Hg. pressure	Compression strength ultimate breakdown lb. per sq. in.
2 lb.	0·22	28	25
1½ lb.	0·23	44	17
1¼ lb.	0·24	55	15
1 lb.	0·24 to 0·25	100	10

*Expanded Plastics Limited.

Insulated sling container for transport of fish built by Messrs. P. Watson, of Lowestoft for Explorator, Ltd., insulated with 3-in. Polyzote.

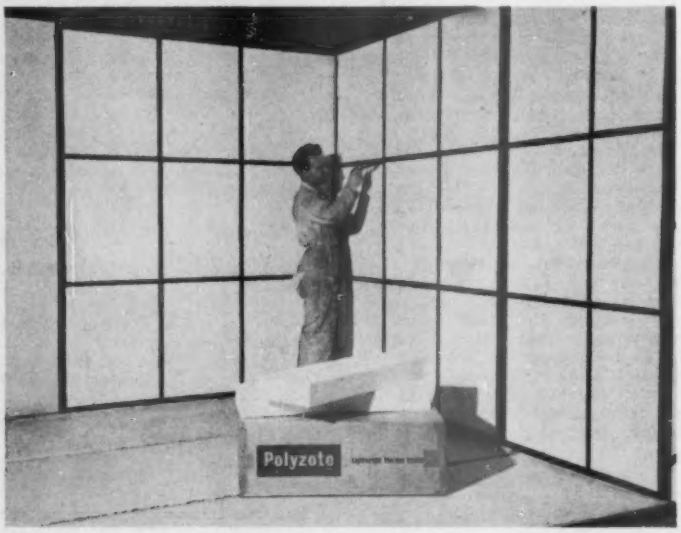
greatest demand has been for 1 lb. a c. ft. material for applications where saving of weight and cost compensate for other desiderata. Hence its popularity for insulation of transport, ceilings, roofs of farm buildings, and, since the introduction in 1957 of the Thermal Insulation (Industrial Buildings) Act, factories and office blocks. To facilitate and speed erection Expanded Plastics Ltd. have recently patented a purlin clip for fixing Polyzote to the underside of corrugated roofs supported on metal angle purlins. In portable cold rooms, display cabinets and conservators, Polyzote has had an immediate success by virtue of its hygienic appearance and the ease with which it can be cut and worked. Expanded Plastics Ltd. also supply sets of Polyzote panels ready cut to size saving the customer time and waste material. Standard sets of panels are also supplied for insulating cold water tanks in domestic houses.

Perhaps the versatility of Polyzote is best displayed in the ease with which it can be accurately moulded to complicated shapes for insulation at certain points in domestic refrigerator cabinets —around door catches, expansion valves and capillary tubes, and, as techniques advance, it may well be that whole cabinets will be moulded of Polyzote before long.

In spite of its initial cheapness there are several applications where expanded polystyrene cannot be recommended without reservations, reservations born of scientific observation rather than native caution. For instance, on cold store floors using fork lift trucks, dynamic loads of 300 lb. per sq. in. may reasonably be expected. If the insulant has a break-down load of 10 lb. per sq. in., it follows that the protective floor topping must be of considerable strength to distribute such loads and provide an adequate safety margin for all except foot traffic.

Perhaps the most perturbing feature of the indiscriminate use of expanded polystyrene is the omission during construction of an adequate vapour seal, particularly at lower temperatures. Because certain expanded plastics show remarkable resistance to the passage of water vapour, it seems to have been assumed that expanded polystyrene would be equally good. In certain quarters it is claimed to be three times better than any other known rigid insulant. Our own researches lead us to believe that in a density of 1½ lb., it is 50 times worse than at least one other well-known rigid insulant and therefore the "hot face" requires as careful a vapour seal as one would normally use with cork.

A word of warning should also be given on the subject of adhesives. In the thermal insulation trade the use of oxydized bitumen at a dipping temperature of about 350°F. is normal practice on most applications, this method being quick, cheap and positive. Expanded polystyrene will not withstand these dipping temperatures; hence one must resort either to lower melting point bitumens, which have a tendency to creep on a warm face, or to more expensive and slower cold adhesives. These cold adhesives, be they emulsions or solutions require careful handling to ensure



800 c.ft. bread freezing room operating at zero Fahrenheit insulated with 6-in. Polyzote, built by Messrs. Stancold of Bristol for Keenes Bakeries Ltd., the distributors being Messrs. Gardiner Sons & Co., using Prestcold equipment.

new insulation, light and strong

These simple-to-mix components give rigid foams to provide the refrigeration industry with a remarkable new insulating material that combines high thermal resistance with strength and lightness. Easily mixed on the site, the components produce the foam in the cavity to be filled. Foams of varying density can easily be made.

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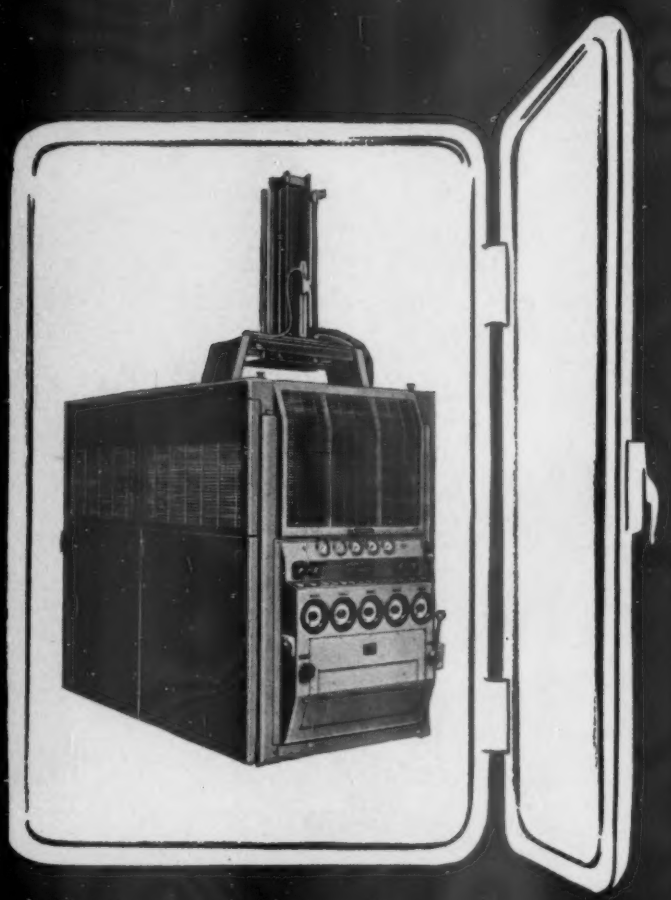
Stand 317 Grand Hall Gallery International Plastics Exhibition Olympia

Inside story of BIG business by DANIELS-LATYMER



★ We are exhibiting at the International Plastics Exhibition — Olympia, 17-27 June, Stand No. 38.

The Daniels/Latymer 30/30 R.D.P. Mk. 11 vacuum forming machine.
Note : *sloping panel in front for easy, accurate control.*

Versatile, supremely capable Daniels/Latymer machines give refrigerator manufacturers these substantial advantages:

COMPLEX MOULDED SHAPES
REDUCED WASTAGE & SPOILAGE
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For whatever process—straight vacuum forming, drape or drape forming with bubble pre-stretching, and others—there is no better machine on record than a Daniels/Latymer.
The Daniels/Latymer range includes machines for 80" x 50" sheet with sandwich heater.

More and more refrigerator liners are being vacuum formed by Daniels/ Latymer machines

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that the water or solvent contained in them is not trapped, and, in the case of solutions, that the solvent will not attack the polystyrene.

This article is in no way intended to denigrate Polyzote or, indeed, any other expanded polystyrene manufactured under controlled conditions. It is an attempt in parvo to evaluate the merits of a new and interesting advance in low and moderate temperature insulation, to point out briefly some of the disadvantages pertaining to its use and to advocate our own policy on thermal insulation—care, good workmanship and attention to detail.

COMPRESSION MOULDING PRESS

T. H. & J. Daniels Limited, Stroud, have had a long association with the design and manufacture of compression moulding presses, and this enables them to offer the plastics industry a wide range of types and sizes of presses of the highest quality. The range of presses includes upstroke up to 250 tons: downstroke and transfer up to 500 tons: side ram up to 250/120 tons: low-pressure, five sizes 12, 30, 50, 100 and 250 tons; hobbing presses, two sizes 500 and 1,000 tons.

NEWS FROM THERMO-PLASTICS LTD.

Once again the production of components for the refrigeration industry by Thermo-Plastics Limited during the past year has increased enormously in volume and in type of component manufactured.

A wide variety of materials and techniques is being employed to enable an over-all service to be maintained with all the leading refrigerator manufacturers in this country, including A.E.I.—Hotpoint Limited, Astral Equipment Limited, Electrolux Limited, English Electric Co. Ltd., Frigidaire Limited, Kelvinator Limited and Messrs. Rubery, Owen & Co., Ltd. Some details of the work at present being carried out are given below.

Complete interior liners of even more complex shapes than hitherto assumed to be possible are being manufactured on a mass production scale, and range in size from liners for 2 c.ft. refrigerators to interiors for 13½ c.ft. refrigerators. They are mainly being manufactured from high impact polystyrene sheeting with a gloss surface, although a certain amount of experimental work has already been carried out on the use of rigid p.v.c. material for this purpose. Considerable promise is shown in this connexion.

The components are all made by the vacuum forming process on machines which the company has specially developed for this purpose, incorporating numerous features for efficient and economic production. Both male and female moulding techniques are employed, and the decision as to which method is preferable in each particular instance is dictated by the design of the component.

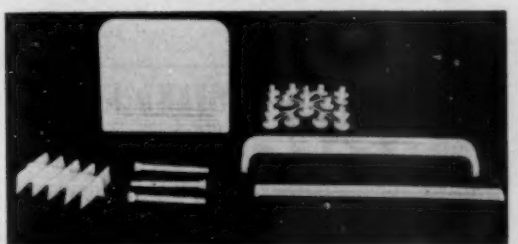
Similarly, door panels in a wide variety of designs are being manufactured using the vacuum forming technique.

It has already been found by refrigerator manufacturers that the use of components of this type has a number of advantages; they are cheaper, lighter in weight and are more attractive in appearance.

The injection moulding division of the company has once again brought out a number of new components produced from high impact styrene, polythene and nylon for the refrigeration industry, illustrated in these columns. They include such items as drip trays, compartment doors, straps, nylon bolts, ice grids, etc.

Another big development during the past year has been the installation

Refrigerator linings in Thermo Plastics copolymer styrene for AEI Hotpoint Ltd. (shown left) and Kelvinator Ltd. (shown right). Below: Various injection moulded refrigeration components (Thermo-Plastics Ltd.)



EKCO PLASTICS began something new and important when they undertook the moulding of all the plastics parts of the latest 3 cubic ft. model for the Frigidaire Division of General Motors.

One intricate assembly, the polystyrene inner lining, is moulded on the ***largest injection moulding machine in this country (capable of producing mouldings up to 210 ozs.).***

The fact that the first job to be handled by this new EKCO machine should be for the Refrigeration Industry is another indication of the closeness of our association. If you have any plastics problem that this machine might help to solve—or, indeed, *any* plastics problem whatsoever—you have only to call on the long experience of Ekco Engineers.

EKCO STAND No. 226 OLYMPIA INTERNATIONAL PLASTICS EXHIBITION

plastics for the Refrigeration Industry

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Members of the British Plastics Federation

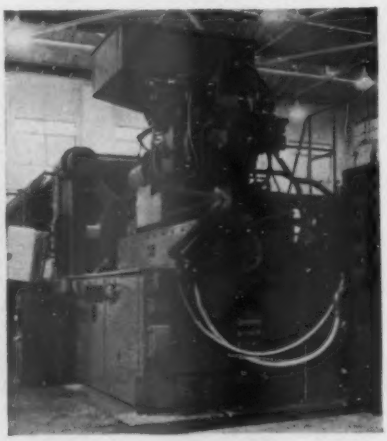
WP5436

by Thermo Plastics Limited of machinery for the mass production of rigid polyurethane foam for insulation purposes. This material can be supplied in densities ranging from 2·5 lbs. per c.ft. upwards. It is being manufactured either in slab form, brick form or as a composite part of insulated structures. In this latter connexion facing materials of p.v.c., high impact Styrene, glass reinforced sheeting or metal are being used, and it is also possible to foam at the back of moulded structures. We are confident that a very great future exists in this connexion, and that our service to the refrigerator industry will be widely extended by its introduction.

This side of our work is, of course, particularly interesting to the commercial refrigeration field where our activities have also been increased.

In addition to the sandwich construction material that we are now manufacturing incorporating our foam, a range of flat glass reinforced sheeting has been introduced and is now finding increasing application for the lining of cold rooms, refrigerated stores, ship holds etc. Once again this material is supplied either plain or bonded to plywood or chipboard, and its installation means that the complete room has a surface of extremely good impact strength, of attractive appearance and a very high hygienic standard. It can easily be cleaned and has proved to be most successful in service.

Considerable development work is also being carried on at the present time in the production of insulated containers of all descriptions, ranging from small carrying cases to large storage units. Once again a variety of materials is being used, lining materials being high impact styrene sheeting, rigid p.v.c. or glass reinforced, and the outside container normally being manufactured from glass reinforced material due to its superior impact strength. Polyurethane or a number of other insulating materials are used for the internal core.



Windsor machine—the largest injection moulder in the country—installed at Ekco Plastics Ltd., now producing liners for Frigidaire.

3 ways

we serve the refrigeration industry—

The insulation you know so well, with the lowest thermal conductivity, lowest water absorption and lowest water vapour transmission of any rigid insulant. Made by Expanded Rubber Company Ltd., Mitcham Road, Croydon, Surrey.

Expanded polystyrene—the lightest, cleanest, cheapest rigid insulant available. Enquiries for boards, blocks and mouldings should be made to Expanded Plastics Ltd., 675, Mitcham Road, Croydon, Surrey.

Polyzote is manufactured in Eire by Insulate Ltd. All enquiries should be addressed to Gibson Agencies, 2 Crown Alley, Dublin. Telephone 70098.

Onazote Insulation Company, an able and experienced team of specialist contractors, fully equipped to carry out any type of installation. For a quotation apply: Onazote Insulation Co. Ltd., 675 Mitcham Road, Croydon, Surrey.

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Thermo-Plastics liner for Electrolux Ltd. in production.

SOME FEATURES OF THE STANDS AT OLYMPIA

INTERESTING NEW PRODUCTS ON DISTILLERS PLASTICS GROUP STAND

Many new products available from the Distillers Plastics Group will be on open display for the first time at the International Plastics Exhibition.

1. *Rigidex Polyethylene.* A special section of the stand sets out to show the entire range of Rigidex polyethylene applications, while Rigidex is also shown, where relevant, in the various sections of the stand.

2. *Rockite Polyester Dough Moulding Compound.* Rockite K.501 dough moulding compound is used primarily in products where good mechanical strength and dimensional stability are required.

3. *New Styron Grades.* Styron 700 and Styron 440, two new heat resistant polystyrenes, are featured in a special display.

4. *Tyril 767—Styron Acrylonitrile Copolymer.* Tyril 767 is ideal where

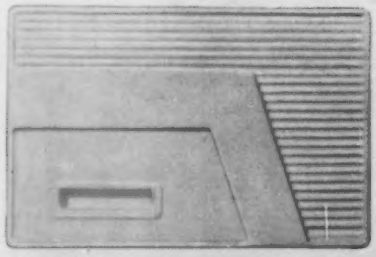
(*Continued on page* 580)

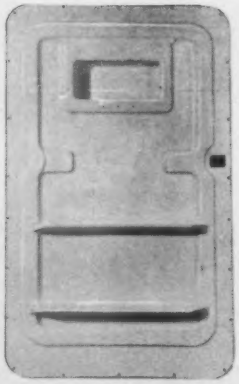
VACUUM FORMING

Refrigeration

EVAPORATOR DOORS
DOOR LINERS · TRAYS, etc.

THE MARK OF CC LTD DISTINCTION





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'Darvic' p.v.c. faced 'Coldseal' Amethyst refrigerated food counter made by Sharp and Law Ltd., Bradford, in D. M. Lister's shop.

Food keeps fresh, sells faster in 'Coldseal' Amethyst refrigerated food counter—

it is faced with 'Darvic'

THIS 'Coldseal' Amethyst refrigerated food counter made by Sharp & Law Ltd., is faced with 'Darvic' p.v.c. sheet. That is why it not only displays food, it keeps it fresh and clean, too. 'Darvic' is an absolutely hygienic material, is completely odourless and will not taint food or drink. The advantages of 'Darvic' do not end there. This outstanding material has high impact strength, resists corrosion and has low thermal conductivity. 'Darvic' is light yet tough and is rigid even in thin sheets. It is easily shaped and is the ideal material for one-piece shapings for complete refrigerator interiors. 'Darvic' is available in a wide range of attractive colours and multi-colour laminates.

'DARVIC'

'Darvic' is the registered trade mark for the rigid p.v.c. sheet made by I.C.I.

ICI IMPERIAL CHEMICAL INDUSTRIES LIMITED · LONDON · S.W.1.

PD.64

transparency combined with toughness and high tensile strength are required.

5. *New Uses for Hycar.* A special section of the stand is devoted to the latest applications of Hycar nitrile rubbers and latices. Among the many Hycar products displayed are oil seals, gaskets, brake linings and de-icing equipment.

6. *Geon PVC Pipe.* High impact Geon PVC is also given special prominence on the stand.

SHELL CHEMICAL COMPANY

A wide and important range of modern plastics materials will be on show on the stand of Shell Chemical Co. Ltd. One of the most interesting products to be featured will be "Carlona" polypropylene. Few thermoplastics materials have created as much interest as this new polymer when it was introduced to the British market in trial quantities by Shell Chemical Company last November. Development applications showing to advantage the properties of this promising new material will be on show. Another thermoplastic with the "Carlona" trade mark which has also attracted much attention and will be featured is high density polyethylene. Shell's Ziegler-type polymer offers increased heat resistance, greater tensile strength, greater rigidity, higher chemical resistance to solvents and lower permeabilities to gases and vapour than polyethylenes produced by high pressure methods. Shell Chemical Company market a wide range of styrene polymers and copolymers including basic polystyrene, toughened grades and acrylonitrile copolymers under the name of "Carinex." Applications of many of these different grades will be on show together with examples of what can be done with "Styrocell" expanded polystyrene (made and marketed by Styrene Products Ltd., a Shell Chemical Company associate). This is one of the newer "foamed" plastics with densities down to 1 lb. per c. ft. which is finding a large outlet as an insulating material in the building and refrigeration trades.

MONSANTO CHEMICALS LTD.

Plastics flooring, plastics walling, plastics ceiling, plastics insulation and plastics balustrading are some of the many special plastics features being incorporated in the construction of one of the most unusual exhibition stands seen in Britain. It is the display of Monsanto Chemicals Limited at the International Plastics Exhibition, to be held at Olympia from June 17 to 27. The stand—No. 76 in the Grand Hall—is planned on three levels, connected by a staircase. Entrance will be from both the gallery and from the ground floor of the Grand Hall. The stand has been designed to show plastics *in use* rather than to show them in merely a "shop window" display. Special features will include: the use of Lustrex polystyrene in the refrigeration industry; Monsanto's polyethylene, now being produced at the company's new factory at Fawley, will be introduced to the trade. A display will also show how grades for every requirement in polyethylene are available from Monsanto. A special section of the stand will illustrate the widespread use of Monsanto's various plastics products by the packaging industry. Part of the ground floor of the stand will include a display by Monsanto Boussois, of France. It will indicate the growing use of plastics in refrigeration.

WILMOT BREEDEN

The following components are being shown by Wilmot Breeden of Birmingham, stand number 214:

Injection Mouldings. The company is showing injection mouldings for the automotive electrical and domestic appliance industries including three-dimensional badges, nameplates, dials, scales, cases and lids.

Domestic Appliance Hardware. A range of domestic appliance hardware will also be exhibited. This will feature: The "Servolatch." A latch mechanism developed for refrigerator and cooker doors. Special features include:—

(1) Simplicity of design, latching only relies on three basic elements.

(2) Automatic pull-in when closing the door.

(3) Automatic compensation for distortion or loss of seal resilience.

(4) Irreversible action, the door cannot bounce open.

(5) Easy door release enabling all forms of door release mechanism to be used.

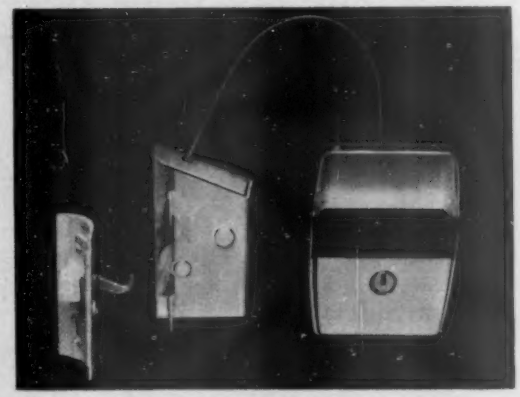
Pumps for Plastics Machinery. In this category, Telchoist Limited of Cheltenham, an associate company of Wilmot Breeden Limited, are featuring a range of screw pumps made under licence from S.I.G. Switzerland.

This Wilmot Breeden latch, which has a simple over-centre spring action, is fitted with a white nylon cam. Due to the outer form of the cam the door may be fully closed irrespective of whether the cam is in the open or closed position.

COMMERCIAL PLASTICS

The Commercial Plastics group exhibit forms a complete exhibition on the first floor of the Grand Hall. Hung in the entrances to the Commercial Plastics exhibit will be a selection of modern paintings by modern British artists. These paintings are part of the collection owned by Dr. Pomeraniec, managing director of Commercial Plastics Ltd., and their progressive theme provides the keynote to the outlook of the companies which he leads. The five participating companies of the group are Commercial Plastics (Sales) Ltd., Anglo-American Plastics Ltd., Iridon Ltd., Greenwich Plastics Ltd., and Fablon Ltd. Commercial

(*Continued on page* 595)



This locking version of the Servolatch principle now in production for refrigerator doors embodies the following injection mouldings: striker body, handle back cover and escutcheon: high impact polystyrene in pale blue. Finger push: hard black nylon.

The Institute of Refrigeration Bulletin

Institute Headquarters: New Bridge Street House, New Bridge St., London, E.C.4 (CENtral 4694)

MEMBERSHIP

At the meeting of members held on May 7, 1959, the following were elected to membership of the Institute :—

Member

Howie, John Abbott, "Little Rockleigh," North Road, Hertford, Herts.

Associate Members

Harriss, Frederick William, Flat 3, Walcot Hall, Lydbury North, Salop.

Michael, William Roger, 16 Belvedere Road, Bexley Heath, Kent.

Wertheim, Reinhold A.P., 19 Woodstock Avenue, London, N.W.11.

Associate

Miller, Alan Charles, 6c, Pine Grove, Weybridge, Surrey.

Graduates

Byford-Bates, Michael, 53 Havelock Road, Dartford, Kent.

Hebatpuria, Madhusudan C., 89 Guildford Street, London, W.C.1.

Jacobsen, John, 18 Church Rise, Forest Hill, London, S.E.23.

Kaikobad, Keki Jalejer, 7 Linden Court, Anerley Park, London, S.E.20.

Lamba, Harpal Singh, 16 Baron's Court Road, London, W.14.

Mausoof, Mohammed, c/o Mrs. Arthur, 96 Juniper Road, Uddingston, View Park, Lanarkshire.

Mukherjee, Deb Kumar, 16 Baron's Court Road, London, W.14.

Yasso, Michael Hermes, 5 Killieser Avenue, Streatham Hill, London, S.W.2.

Students

Bingham, Warwick, 125 Bow Lane, Finchley, London, N.12.

Lyndon, Kenneth David, 4 Almond Way, Mitcham, Surrey.

ROCKET ENGINE PROPELLENT

"IT is reasonable to ask what might be the future of cryogenic propellents," said Mr. D. Hurden, B.A., of the de Havilland Engine Co. Ltd., in a lecture before The Institute of Refrigeration in London last month. "The V.2 campaign required about 13,000 tons of liquid oxygen a year. Making reasonable assumptions, the rocket-propelled interceptor fighter system might have used 30,000–40,000 tons a year. If mankind is sufficiently foolish to plunge the world into another war, no country would need to fire more than 50 large missiles with nuclear warheads to cause immeasurably more devastation than the 4,200 V.2s and only about 3,000 tons of oxygen would be needed to do this. However, it is no consolation that methods of mass destruction could bring about an economy in propellents.

"It is rather to be hoped that a use for such propellents will be found in the attainment of space travel. At present less than a 1,000 tons of liquid oxygen a year are expended in the launching of satellites and probe rockets which are the first steps towards that end. It is in this field that the consumption of other cryogenic liquids is likely to increase rapidly. Liquid fluorine gives a higher

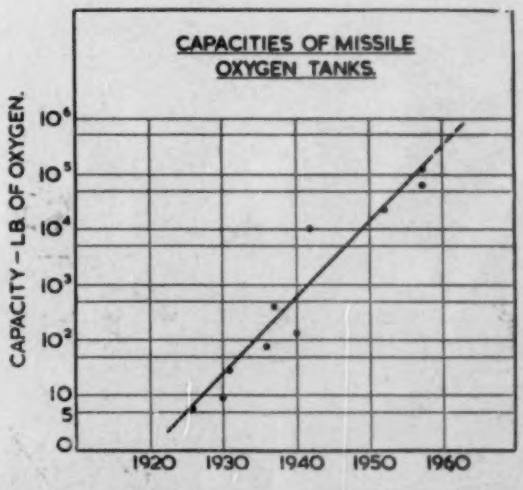


Figure showing rate of growth of liquid oxygen tanks.

performance than liquid oxygen with many fuels, but its high cost is likely to prevent its widespread use. It could profitably be used in the upper stages of a multi-stage vehicle and about one ton would be used on each flight. In 1957 the American rocket industry used about 100 tons of fluorine, and it has been estimated that the demand will soon rise to about 1,000 tons a year.

" Power for the more ambitious flights into space may be supplied by the nuclear rocket in which a working fluid of low molecular weight is heated in a reactor and expanded through a propulsion nozzle. Shepherd has calculated that a 2-ton satellite could be put into orbit by a single-stage nuclear rocket using hydrogen and weighing initially 130 tons. A 60-ton payload would require a launching weight of 1,000 tons, and such a rocket would use a ton of liquid hydrogen each second. The problem of designing an airframe to carry large quantities of liquid at exceedingly low temperature is one of considerable magnitude, and it is unwise to attempt to forecast when such vehicles might be built, let alone the frequency of their voyages."

The author commenced his paper, the full title of which was " Cryogenic Liquid for Rocket Engines," by a definition of the word " cryogenic."

According to the Shorter Oxford Dictionary, the word " cryogenic " is derived from two Greek words meaning " frost-producing." " Cryogenic liquids used in rocket engines are therefore those fuels and oxidizers which boil below 0° C. and the commonest of them are listed below," went on Mr. Hurden.

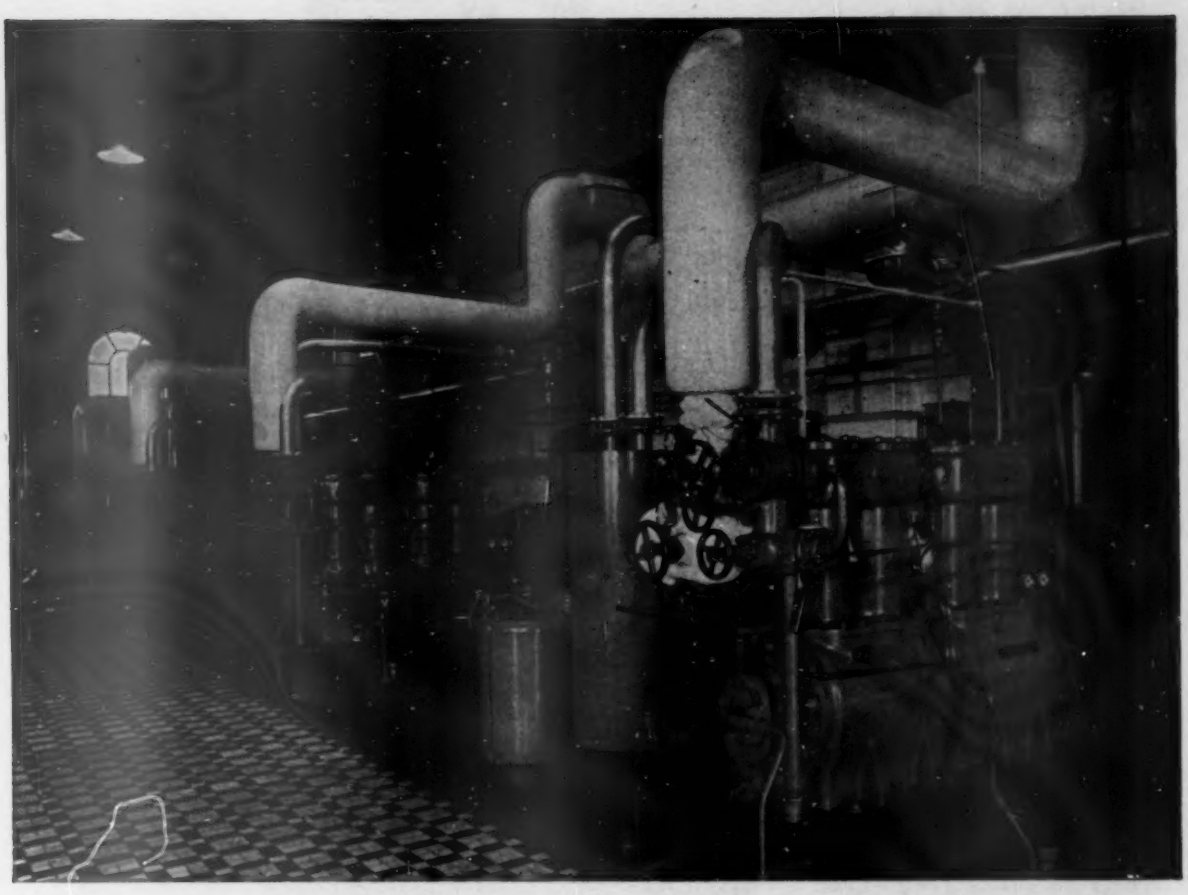
Substance	*Class*	*Boiling Point °C.*	*Density Gm/C.C.*
Ammonia	Fuel	– 33° C.	0·66
Methane	,,	– 161° C.	0·38
Hydrogen	,,	– 252° C.	0·17
Oxygen	Oxidizer	– 183° C.	1·13
Oxygen difluoride	,,	– 145° C.	1·50
Fluorine	,,	– 188° C.	1·54

" Ammonia has recently become prominent because it is the chosen fuel for the North American X.15 research aircraft. Although its boiling point is comparatively high, its vapour pressure at normal ambient temperatures is 150 lb. per sq. in. and it therefore has to be treated in the same way as the other liquids.

" Oxygen, oxygen difluoride, and fluorine all boil at roughly the same temperatures, and techniques which have been developed for dealing with liquid oxygen can be used to deal with the others, with the complication that they are both highly corrosive and therefore require careful choice of materials. Since they are also both toxic their vapours cannot lightly be allowed to escape into the atmosphere."

The paper dealt in the main with the rocket engineer's approach to the handling of liquid oxygen and referred to differences enforced by the use of fluorine and its derivatives. Some of the special difficulties presented by liquid hydrogen was also mentioned. After briefly reviewing the history of the use of liquid oxygen in rockets, the author considered the process of filling the tanks and then described what happened to the liquid in the engine.

Ranco Ltd. recently held a two-day European Agents Conference in Glasgow. A wide variety of technical and commercial problems together with future sales plans were fully discussed. The conference ended with a dinner at the Caledonian Hotel, Edinburgh. The photograph shows the "Agents" group—reading from left to right: Mr. A. Reiert (Germany); Mr. A. Konanz (Germany); Mr. L. Berg (Norway); Mr. G. Eisner (Italy); Mr. N. Best (Managing Director Ranco Ltd.); Mr. J. Hunter (Director, Ranco Ltd.); Mr. A. Vaugelade (France); Mr. F. Heynen (Belgium); Mr. C. Hempel (Sweden); Mr. H. Lindstedt (Sweden).



Refrigeration

Refrigerating compressors of the monobloc type are widely used in the manufacture and storage of foodstuffs. This installation comprises four 8″ x 8″ quad and an 8″ x 8″ twin monobloc compressor, driven by a total of 675 h.p., and have an installed capacity of 6¼ million B.t.u. per hour It is installed at the margarine plant of the Co-operative Wholesale Society at Irlam, Manchester. The equipment manufactured by J. & E. Hall ranges from small refrigerated cabinets and compressors of ¼ h.p. to centrifugal compressors of the largest size in use today.

J. & E. HALL LIMITED · HALLFORD · DARTFORD ENGLAND

J. & E. HALL

LIMITED

DARTFORD · KENT

AP 203

Frozen Food Company's New Sub-Zero Holding Store

The new store has a central loading bay which will take as many vehicles as can be handled by the stores at any one time, and is adjacent to the fruit and vegetable factory.

AS we briefly announced in our May issue, the second major stage in the current expansion programme of Eskimo Foods Ltd., processors of quick-frozen foods, was completed recently with the opening of a big new cold store at Pelham Road, Cleethorpes.

The cold store, incorporating the latest construction, insulation and refrigeration methods, has a capacity of 820,000 c.ft. and covers an area of 256 ft. by 207 ft.

Costing more than £225,000 it will serve as the main despatch point for products from various Eskimo fish, fruit, vegetable, and poultry processing plants in the area. It will hold more than 8,000 tons of food for the company's distribution outlets—retail grocers, fishmongers, greengrocers, supermarkets, catering establishments, ships and airlines.

The new store is coming into operation approximately six months after the completion of the first stage of the expansion programme—the opening of the £120,000 cold store on the other side of the Humber, at Walcott Street, Hull.

The third stage will be the opening, scheduled for early next year, of a fish processing plant being built by Eskimo's parent company, Associated Fisheries Ltd., at Orwell Street, Grimsby. When completed, this plant will have a total capacity of 500,000 lb. of fish a day—or enough for 944,000 fish meals a day.

Handling of goods into and out of the new cold store will be by pallet transporters and fork-reach trucks. The accent throughout will be on ease and speed of movement.

The building has two large chambers, each 110 ft. wide by 196 ft. long and 20 ft. high, operating at a temperature of –20° F. There will be no internal stanchions to impede movement.

Between these large chambers will be a smaller chamber—called a " break-up " room—which will be common to both, through which all goods will be routed before despatch. With the exception of the administration and welfare block the whole of the area will be at ground level.

The entire building is operated, heated and lit by electricity, and a large transformer has been incorporated in the engine room situated at the rear of the break-up room.

Construction

The design of the store was started early in 1958. Planning permission was received on May 2, and building commenced on July 1.

To comply with the rapid construction programme of nine months, a steel-framed building was necessary with brick infill panels. The steel columns are protected by special precast concrete blocks, built up as the brick work proceeded, and the space between filled with concrete. Each of the stores has a clear area of 110 ft. by 196 ft., without internal columns, with a capacity of approximately 4,000 tons each. For this reason they have been constructed as separate buildings coupled by flexible joints, with the central office, break-up and engine room section in the centre to allow for thermal movement of the buildings, particularly when cooling down.

THE NEW FD RANGE OF STERNE EVAPORATIVE CONDENSERS

(FORCED DRAUGHT TYPE)

FOR AMMONIA OR FREON

COMPACT YET ACCESSIBLE | **STANDARD RANGE 20 T.R. to 150 T.R.**

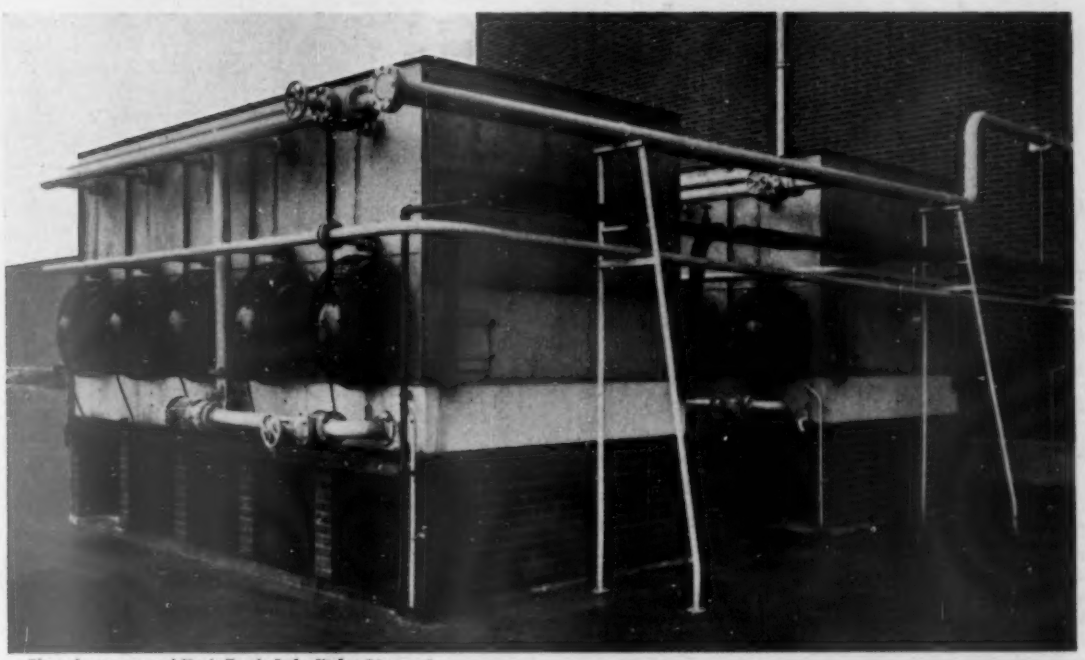


Photo by courtesy of Kraft Foods Ltd., Kirby, Liverpool

The Photograph shows 2-133 T.R. units operating in conjunction with 2-285 H.P.—8VQC (V Type) compound ammonia compressors.

SPECIAL FEATURES:—

Efficient condenser element of novel design with low resistances.
Quiet, low speed fans.
Special water distributing system.
Negligible windage loss.
Easy to clean and service.

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BRISTOL	Bristol 24038	**NEWCASTLE**	Newcastle 66-1048	**BELFAST**	Belfast 59211
CARDIFF	Cardiff 26408	**HULL**	Hull 31198	**DUBLIN**	Dublin 71316

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How we beat the coldroom bogey

The problem—costly breakdowns

Coldrooms must be kept cold at all costs. Or must they? At Prestcold we think otherwise. We maintain that coldrooms must be kept cold *at less cost*. For, when flywheels and pulleys work loose, or belts break or crankshaft seals give trouble, it's small comfort to the owner that his motor can be quickly repaired. Repairs and servicing are going to cost him money in the end, and he knows it.

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On the principle that prevention is cheaper than cure, we decided to develop a really reliable compressor unit motor. And we did it—in the Super Presmetic series. To be technical, the Super Presmetic is a direct-drive motor compressor. To be plain, it does away with all the parts that cause most trouble—driving belts, crankshaft seals, pulleys, flywheels. It is reliable indeed, *and the motor compressor is guaranteed for five years.*

MONEY, SPACE AND TROUBLE SAVED

Its advantages don't end there, either. To money saved on less maintenance, add the money saved on running costs, because less power is lost in friction. Then add the space saved, because the Super Presmetic is extremely compact. Finally, subtract a whole lot of trouble—in oiling and cleaning, checking and worrying.

CAN PRESTCOLD HELP YOU?

If you have a problem in refrigeration you'll probably find that existing Prestcold equipment will deal with it. Because all our equipment comes from a long line of intense research. But even if yours is an entirely unique problem please let us know about it. We shall be glad to help. Write to your Prestcold distributor, or to Prestcold Commercial Sales Department, Cowley, Oxford.

FOR FRESH IDEAS...IT'S

Prestcold

PRESTCOLD DIVISION
PRESSED STEEL COMPANY LIMITED, COWLEY, OXFORD

To eliminate internal columns in the cold chambers and consequent loss of space, the stores are spanned by steel trusses at 13 ft. 6 in. centres across the full width. For ease of maintenance in the roof space the ends are raised by 6 ft. 6 in., rising to 8 ft. in the centre. The sides are covered by aluminium sheeting and the roof with aluminium decking designed to span between trusses finished with ½-in. insulation board and bituminous roofing felt. Continuous ridge ventilations run the length of each store to allow air entering below the sheeting to pass the roof space and prevent heating up in the summer. Solar radiation is minimized by use of white mineral finish to roof and light-coloured bricks.

The offices, the only two-storey part of the building, are situated over the working area. They have external walls to Pelham Road, with continuous glazing and a timber roof on steel joists. Internal office partitions are the light-weight demountable type and heating is by electric convectors.

Layout

Packages of prepared, wrapped, packed and cartoned products will be delivered by pallet trains from the factory (similar to those seen on railway platforms) or by road transport, to either of the entrances in each of the two stores. The front of the stores is protected by a continuous glazed canopy. From here the packages are collected and transported on their pallets into the building.

The openings are exactly positioned by the size of the standard pallets 4 ft. by 3 ft. 4 in. so that the depth of storage on each side of the 7 ft. 6 in. gangways is varied to accommodate large or small quantities of the various products. The height of the openings is governed by 30-cwt. fork reach trucks, and the width of the gangways by the turning circle of the trucks.

Within the store the maximum number of pallets that can be stacked without deformation is found by experience to be four pallets, *i.e.* 16 ft. ; plus working space and allowance for the cooling coils operating at 20° F.

When the products are required for despatch they are taken again by fork lift to a central 35-ft. by 95-ft. break-up room, which is maintained at a temperature of −50° F., and stacked two pallets high where the smaller quantities needed are easily extracted. Handlers can pass the various products and extract from any of the 50 lines the individual quantities required for each despatch order.

From the break-up room the orders leave through further refrigerated doors and past a checker's office where they are loaded into the refrigerated vans for despatch by road.

On either side of the break-up doors are staircases leading up to a mezzanine floor overlooking the working area on which there are the toilets and a drying room for employees' clothing. Above are offices for the stores supervisor, his staff and a mess room for the cold store employees.

Each of the two cold stores incorporates the latest methods of temperature control, air circulation and defrosting. The stores, laid out to provide the maximum storage space, house the most up-to-date mechanical handling equipment for simplicity and speed. Each store will be operated by only four men.

Each store is lit by special fluorescent tubes along the main trucking aisles specially designed to operate at −20° F. The lighting scheme is arranged to give a high intensity at the farthermost point and takes advantage of the reflectivity from the snow formed on the refrigerator coils. Each store has emergency alarm equipment to be operated by anyone accidentally shut in.

Handling and stacking of Eskimo quick-frozen foods are fully palletized in the new store.

Insulation

The insulating material consists of white polystyrene expanded as a foam into rigid blocks and weighing 1 lb. and 1½ lb. per c.ft.

To prevent the entry of water vapour and consequent formation of condensation on the cold inner surfaces with subsequent formation of ice which would destroy the insulation value, aluminium foil and bituminous compound are applied to the inside of the brick walls with joints carefully lapped and sealed. Against the foil are fixed two 3½-in. layers of foamed polystyrene laid in blocks breaking joint, bonded together with coldset. The outer layer is protected from damage by the pallets by a concrete curb. This also provides an air space between the cartons and the wall for the passage of refrigerated air.

The floors are similarly protected except that on the insulation is laid 4 in. of carefully mixed and power floated granolithic concrete, on which is painted the location of the pallets. Beneath the floor insulation there is an automatically controlled electric blanket to prevent the sub-soil freezing and heaving up the floor.

The ceiling is fixed direct to ¾-in. high-quality chip board on timber joists between the steel trusses. Through these joists are also bolted the hangers for the cooling coils below, each packed around and above with further insulation to prevent the penetration of heat from the roof space.

List of Contractors

General contractors : Taylor & Coulbeck Ltd.
Steelwork : Sommerville Barnard Ltd.
Refrigeration Plant : J. & E. Hall Ltd.
Insulation : C. L. Whitaker & Co. Ltd.
Electrical : Harry Carr Ltd.
Roofing : F. McNeil & Co. Ltd.
Bricks : Wilkinson & Houghton Ltd.
Steel Shutters : Dennison Kett Ltd.
Windows : Aygee Ltd.
Aluminium cladding : Dalton Ltd.
Electric installation : Panelec Ltd.
Fork reach trucks : Conveyancer Ltd.
Transporters : Yale & Towne Ltd.
Expanded polystyrene : Styrene Products Ltd.
Quantity surveyors : Monk & Dunstone.
Architects and engineers : Jenkines, Manning, Potter & Clamp.
Eskimo engineer : R. T. Marshall.

Marco Sales Convention

At the recent sales convention held by Marco Refrigerators Limited, at the Mayfair Hotel, London, the spirit of progress which marks the advance of the company in recent years was evident throughout the proceedings.

Plans for the future were outlined by Mr. R. J. Simpson, managing director and Mr. J. D. Young, general sales manager.

Guest speaker was Mr. Fraser Garioch, managing director of the Winter Thomas Company, Marco's advertising agents. Marco's advertising and sales promotion plans were outlined by Mr. D. J. Percival who introduced a new style of literature to the delegates.

Mr. E. A. Sprange spoke on the importance of after sales service and Mr. H. Schkud reported on the new design of future Marco models.

High spot of the day came when Mr. R. J. Simpson introduced the new models in the 1959 range. These models again stressed the progress of the company.

First to be introduced was the "Victor De Luxe." This version of the popular 13-c.ft. service cabinet embodies adjustable shelves and interior improvements and will be available in a wide range of colours.

Next came the "Manor." A new all-steel construction, self-contained 25-c.ft. service cabinet.

The "Streatham" and the "Mitcham" followed. The former is a 9·2-c.ft. ice cream or frozen food conservator and the "Mitcham" a frozen food display cabinet of similar capacity.

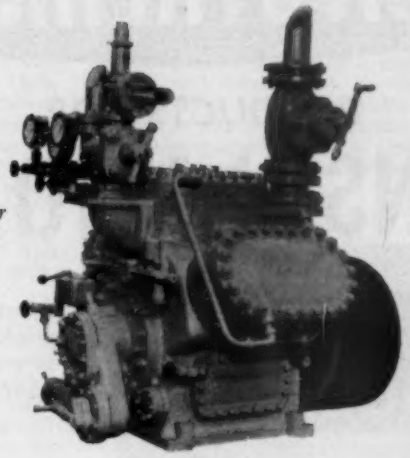
The larger frozen food cabinets were represented by the "Mayfair," a new 6-ft. or 8-ft. open-top display cabinet with deep vision front window and a new addition to the "Majestic" series, the "Air Flow Majestic." This new model incorporated forced air cooling (Marco "Circoolair") and automatic defrosting.

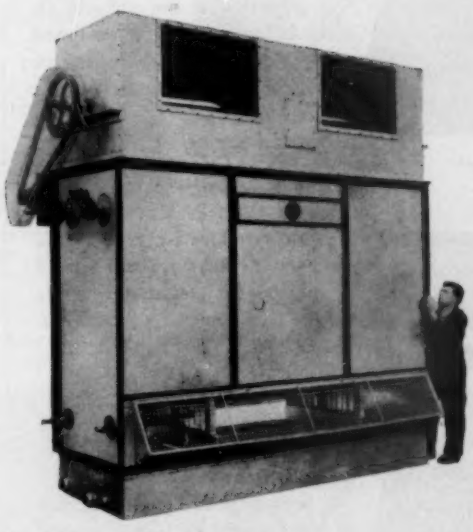
A new display counter also takes its place in the Marco range. The "Weybridge" with its three-quarter vision display window and improved shelving is certain to become popular in the near future.

Marco's Airflow Majestic.

FOR :
AMMONIA
OR "FREON"
COMPRESSORS
CONDENSERS
COOLERS
ETC.
FOR ALL PURPOSES :
AIR CONDITIONING
INDUSTRIAL
MARINE
COMMERCIAL

Model A56
Ammonia Compressor





60 Ton Induced Draught "Freon" Condenser

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A cold applied bitumen/rubber emulsion adhesive for fixing cork, expanded polystyrene and ebonite to porous surfaces. It is designed for use where high resistance to the passage of water vapour is required.

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COMMERCIAL AND INDUSTRIAL NEWS

"**J.D.**" **Insulating Co. Ltd.** have recently moved into their newly completed modern factory at Brokenford Lane, Totton, Southampton (telephone : Totton 2621/2). This factory has been built in order to cater for the expansion of the business in the south, and is equipped with up-to-date plant and machinery for the production of sectional cold rooms and service cabinets. "J.D." are also in a position to handle these inquiries for insulation of built-in cold rooms, large cold stores, insulated doors and frames, pipe lagging, etc.

* * *

At the 13th ordinary general meeting of **Negretti & Zambra Ltd.**, held at Stocklake, Aylesbury, Mr. P. A. Negretti, the chairman, in the course of his speech, said : "Last year was another of steady, if unspectacular, progress. Our turnover rose for the 12th time in succession, from £1,478,942 to £1,578,514 and although our profit margins, like those of many other companies, have contracted, our trading profit has advanced from £306,453 to £314,007, our fixed assets to £901,518 ; by no means unsatisfactory figures. . . . Your board have recently completed the purchase of the whole of the share capital of New Western (Engineering) Ltd., of Leeds, who have for some time now been making our instrument panels with a marked degree of success. They have achieved a very high reputation in the instrument world by their work on the control rooms for the four Calder Hall nuclear reactors and among the contracts they have recently secured are those for the control rooms for the four reactors at Chapel Cross nuclear power station."

John Clephane and Sons Ltd., of Pitt Street, Edinburgh, staged a display of I.W.O. frozen food merchandisers and farm freezers in their premises during May. These Swedish-designed units are powered by "Tecumseh" (U.S.A.) sealed units and are being offered by Clephane on h.p. terms. During the exhibition period the firm ran a film show under the title "Selling Frozen Foods." Birds Eye have approved the quick-frozen cabinets in this range for the sale of their products.

* * *

Furse Wholesale Ltd., of Nottingham, announce the appointment of Mr. Rowland March as sales manager. Mr. March, who is 48, and has been with Furse for the past 29 years, has been one of the company's Leicester office representatives for many years. He is vice-president and past hon. secretary of the Leicester Electrical Society. Mr. March will be working under Mr. T. C. Bond, who remains sales director.

* * *

Kelvinator Limited have appointed Mr. H. Cameron as executive director of manufacture. He will be responsible for all aspects of manufacture of the company's products. Mr. Cameron, who is a member of the Institute of Works Managers, resigned from G.E.C. where he was general works manager of Coldair Limited. His engineering career began in Sheffield in 1922. In 1932 he joined Belling & Co. Ltd., concentrating on what was then the new wet process of vitreous enamelling. In 1935 he joined the Parkinson Stove Co. Ltd., reorganizing production in the cast-iron department and subsequently the sheet metal department. Throughout his career he has specialized in trouble-shooting in a wide variety of production processes. In this capacity he was subsequently connected with the

Mr. H. Cameron.

Vulcan Stove Co. of Exeter, manufacturers of a range of domestic appliances. Throughout the war years he controlled the domestic appliance department of H.M.V., producing engineering prototypes for the three services.

Avon Refrigeration Co. Ltd., of Devizes, recently staged most successful shows of Kelvinator, I.W.O. and other commercial equipment at Bristol and Bath.

SAFETY IN ENGINE ROOMS

IT is obvious that with modern large automatic or semi-automatic ammonia refrigerating plants ability to deal instantly with any gas leakage or accidental blow-out is very important. The " gas mask " type of respirator is all right for very low concentrations but, in the event of anything more serious developing, compressed air breathing apparatus is essential. Experience has shown, however, that when this apparatus is maintained in the usual, fitted box it takes quite some time to be taken out, assembled and put on by the user.

Accordingly one of the engineering staff of Hay's Wharf Ltd., Mr. S. Morrisey, has devised a wall bracket on which the breathing apparatus can be mounted in " ready to wear " condition so that it can be put on and adjusted ready for use in a matter of seconds. This arrangement is clearly illustrated in the attached photographs.

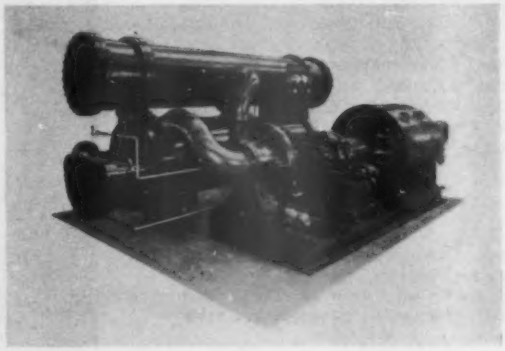
" M.R." learns from the chief engineer of Hay's Wharf Ltd., Colonel H. Randal Steward, T.D., that Mr. Morrisey is specifically appointed in charge of all safety equipment in their various engine rooms and for training all personnel in its use, for which purpose he conducts a brief monthly " drill " at each engine room.

ENGINE-ROOM DRILL — 1. Compressed air breathing apparatus hanging on ready to wear bracket in shift engineers lobby adjacent to cold store engine room. Emergency gear also includes long rubber gauntlets and battery operated hand lamp. 2. User backs into harness inserting arms through main supporting straps. There is no weight on the user at this stage as the apparatus is still supported on the bracket. 3. After the shoulder straps are in position it is only necessary to walk forward when the apparatus will slide off the bracket. Here the user has already fastened chest straps carrying pressure gauge and is fastening belt. 4. Here the user has checked the pressure in the cylinder, opened the main control valve and donned the face piece. Having put on the gauntlets, he has merely to pick up his lamp and is ready for action.

What are believed to be the first, single-stage, turbo compressor water chilling systems to be exported from Great Britain to the Middle East are being despatched this month from the London works of **York Shipley Ltd.** for use in the air-conditioning services of the Ahmadi Hospital, Kuwait, now being built for the Kuwait Oil Company Ltd. The Brightside Heating and Engineering Company Ltd., of London, are the main contractors for all the air-conditioning installations and for all other services in the hospital, while the consulting engineers are Messrs. Huckle & Durkin, of London. Equipment being supplied by York Shipley Ltd. will comprise two single-stage, turbo compressor water chilling systems using " Arcton 9 " ("Freon 11") refrigerant. Each system is rated to cool 875 gal. per minute, recirculating chilled water from 53° to 45° F. This represents a heat removal of 4,200,000 B.t.u. per hour. Basically each turbo system comprises a high-speed York,

(*continued on page* 595)

The advantages of Onazote for low temperature insulation in fishing trawlers and other vessels are fully explained in a new illustrated booklet " Keeping fresh at sea," issued by **Expanded Rubber Co. Ltd.** The five outstanding characteristics of Onazote for this purpose are given as resistance to heat, resistance to water-vapour, resistance to water-absorption, lightness and freedom from bulk, permanence. Some of the many vessels insulated with Onazote are listed. Calculations showing the exact improvements in insulation achieved by the installation of Onazote are given and the three basic methods of installation are explained in detail.



The York single-stage, turbo compressor water chilling unit.

BUYERS' GUIDE

air conditioning and refrigeration

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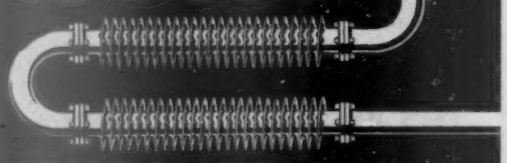

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George Tabor, Ltd., Imperial House, Pudding Lane, London, E.C.3. 'Phone: Mansion House 8044. Wires: "Passport, London." A strong and well-established organization for marketing FROZEN FISH throughout the U.K. and Europe. Proprietors of "NEWBAY" and "TASAM" Salmon and other Frozen Fish. Producers of Oysters and Smoked Fish, Marinated Herrings and Sprats.

MEAT

Thomas Borthwick & Sons Ltd., Audrey House, Ely Place, and Central Markets, London, and the Provinces. Telegrams: "Overdraw, London." Tel.: Holborn 5234 (7 lines).

Telegrams: Corktree, London. Telephone: Shoreditch 6754 (2 lines)

PATRICOLD

COLD ROOMS & CABINETS

are made only by

W. PATRICK & SON LTD.

LOCKFIELD AVE., BRIMSDOWN, ENFIELD, MIDDLESEX

Telephone: HOWard 1579

ESTABLISHED 1873

single-stage, turbo compressor driven through a David Brown speed increasing gearbox by a 450-h.p. Bruce Peebles high-tension squirrel cage motor, specially constructed in accordance with local supply conditions. The evaporator and condenser are of the horizontal multipass shell and tube pattern with specially designed side connexion water boxes. The units are designed on the " package " principle and are entirely self-contained, occupying a floor space of approximately 11 ft. 6 in. by 20 ft. Both are operated from a central control panel by Watford Electrical & Manufacturing Co. Ltd., which, among its many functions, will include the automatic starting and stopping of the plant which incorporates infinitely variable control of capacity between 5 per cent. and full load. In both the design of the condensers and selection of materials used, special consideration had to be given to the problems arising from insufficient fresh water supplies, and the necessity of using sea water for their cooling. " Arcton 9," the refrigerant used, is non-toxic and non-inflammable and presents no hazards in operation. Its low-pressure characteristics make it very easy to handle.

* * *

Union Carbide Limited, chemicals division, announce the appointment of Mr. J. C. Marshall, B.SC., to the newly created post of southern district manager. In this capacity Mr. Marshall will be directly responsible for all chemical marketing activities for the whole of the south of England, including the south and west midlands. All the technical representatives now covering these areas will be responsible to Mr. Marshall in his new capacity.

PLASTICS IN REFRIGERATION

COMMERCIAL PLASTICS

(*continued from page* 580)

Plastics (Sales) Ltd. will show a very wide range of thermoplastic film and sheeting and their multitudinous applications. Polythene film in its many forms will be displayed by Anglo-American Plastics Ltd. Of special interest in this section of the Exhibition will be the Lister E-Z bagging machine. Demonstrations will show how polythene layflat tubing is made up into a cover for garments. This demonstration will be of particular interest to launderers, dry cleaners and garment manufacturers. As well as films for packaging—PVC, polythene and the newest material, polypropylene — the group also supply sheeting for vacuum forming through Iridon Ltd. Applications of polystyrene, unplasticized PVC, low pressure polythene, rigid PVC and polypropylene may be seen.

TELEGRAPH CONSTRUCTION & MAINTENANCE CO. LTD.

Visitors to The Telegraph Construction & Maintenance company's stand will have a preview of an important product which the company will be manufacturing and marketing in the course of a few months. This is sheeting made by extrusion from PVC, toughened polystyrene, polythene of low or high density and other materials, with special applications in vacuum forming and constructional work. There will be a demonstration of dip-coating with Telecothene powder, with special emphasis on the new Telecothene H.D. (high density), which gives an exceptionally tough and durable anti-corrosive coating. Though specially recommended for utilitarian purposes in industry, it is also available in a range of attractive colours for decorative effect and identification.

HALEX WILL FEATURE FRIDGE COMPONENTS

The Halex industrial department will be showing a wide range of component mouldings for refrigeration, radio, television, motor car and other general engineering trades. Of special interest will be a feature of injection moulded evaporator doors, both single shell and double insulated doors, with elaborate three-dimensional internally sprayed decorative finishes. Also on display will be a large range of vacuum-formed refrigerator cabinet liners and door panels. In this connexion it is interesting to note that although our vacuum-forming capacity was trebled in 1958 to meet with the demand for this type of work, it has become necessary to provide for a further increase of over 150 per cent. in 1959.

A view of one of the vacuum-forming shops showing Halex-plant producing deep drawn refrigerator cabinet liners.

LUTON MEAT PLANT

(*continued from page* 552)

that the refrigeration equipment should be more than adequate for the work envisaged so that should conditions be extreme or the load considerably increased, the equipment would be sufficient to deal with it.

All the refrigeration pipes, wiring etc. are in specially concealed ducts which are readily accessible, should service be required.

Transport

Luton's new Meat Market will be served by the finest modern transport in the area. The Luton Meat Company operate a fleet of Thames Traders, supplied by Luton Commercial Motors Ltd., of Dunstable, Bedfordshire.

These robust Ford trucks are designed to cope smoothly with the exacting daily task of meat distribution. They are toughly built on a long wheelbase chassis and powered by a 100 b.h.p. six-cylinder o.h.v. diesel engine. A four-speed synchromesh gearbox, open drive prop. shaft and extra strength hypoid rear axle contribute to powerful and reliable performance.

In addition to the refrigeration plant and lighting, air curtains have been fitted between the cooled rooms and the loading bay which ,again, is lit by concealed twin tube Crompton Parkinson fittings. Eight socket outlets for battery charging and anti-frost heaters for lorries, which may well be parked at the bay overnight, are provided on the loading dock.

To avoid " frost heave," soil heating cables with thermostatic control have been laid underneath the freezer.

List of Contractors and Suppliers

Main Contractors : Messrs. Jarvis (Harpenden) Ltd., Vaughan Road, Harpenden, Herts.
Refrigeration : Bedford Refrigeration Co. Ltd., Windsor Road, Bedford.
Electrical Installation : Shoolbred Electrical Co. Ltd., Langley Street, Luton, Beds.
Overhead Tracking System : Lockerbie & Wilkinson Ltd., Tipton, Staffs.
Weighing Mechanisms : Berkel Auto Scales Ltd., London.
Internal Communications : Telephone Rentals Ltd., London.
Heating : Jarvis (Heating) Ltd., Harpenden, Herts.
Flat Roofing : Standard Flat Roofing Co. Ltd., London.
Artificial Stonework : J. A. King & Co. Ltd., London.
Terrazzo : Malacarp Terrazzo Co. Ltd., London.
Accotile Flooring : Rowan & Boden Ltd., Luton, Beds.
Plastering : Pollock Bros. (London) Ltd.,
Balustrading : W. H. Ward, The Forge, Batford, Herts.
Acoustic Telephone Booths : Burgess Products Ltd., Hinkley, Staffs.
" Insulite " Window Units : Pilkington Brothers Ltd., St. Helens, Lancs.
Chasis (Transport) : Luton Commercial Motors Ltd., Dunstable, Beds.
Paintwork (Transport) : Motor Bodies (Luton) Ltd.
Bodies (Transport) : Walkers & County Cars Ltd., Fleet, Hants.
Hand Trucks : Kings Cross Truck Co. Ltd., London.

DRY AIR PLANT

(*continued from page* 547)

reservoir, which is also constructed in duplicate, with each half serving its own dehydration circuit.

The entire equipment works automatically on a time-controlled basis, the control being effected through a multi-circuit cam-type timer which is adjustable in regard to period, length and positioning. It is driven by a fully synchronous a.c. motor giving timing as accurate as the mains. This timing unit operates individual solenoid valves controlling the various air and refrigeration circuits.

The cabinet is constructed of welded angle-iron frame, surrounded on all sides by protective panelling incorporating louvred openings where required. A sloping console at about waist height carries small red lights which indicate all switching operations. Adjacent to the indicators are three-way control switches which together allow any of the automatic operations to be performed manually.

The remainder of the sloping console is taken up by the refrigerant " output " and " suction " pressure gauges, the main air pressure gauge, together with an isolating three-phase mains switch for both air compressor and refrigerant compressor control. Centrally disposed on a vertical panel above the console is an after dehydration pressure gauge, together with two air point dial reading thermometers.

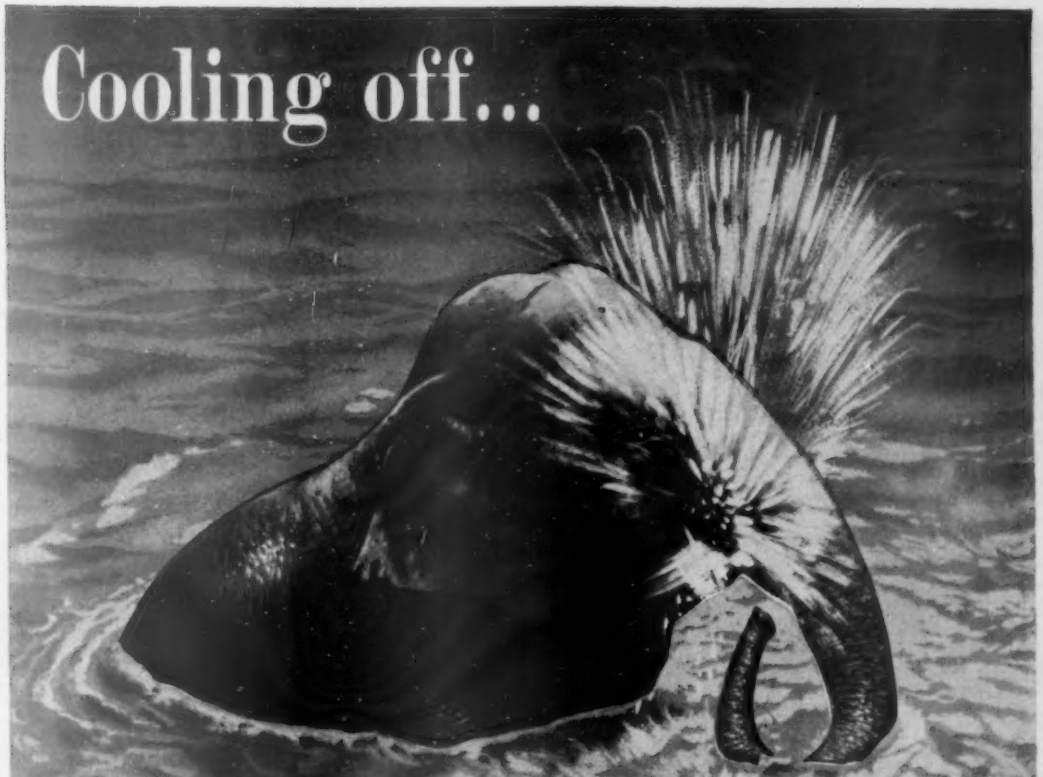
To summarize the main features of this new Pathfinder cabinet, it provides air dehydration to a dew point of –40° C. (or approaching –50° C. for special applications) at pressures of 15 to 60 p.s.i.g. with flows up to 20 c.f.m. obtained with either the alternative rotary compressor or an additional outside supply. The complete unit can be operated manually independent of the normal time-control, and the air is available only 30 minutes after switching on. Total horse-power, including the refrigerant plant, is only $3\frac{1}{4}$.

The applications for the cabinets are numerous and many obvious ones spring at once to mind. These include the pressurization of clean assembly cabinets, film drying cabinets and nitrogen-controlled atmosphere cabinets (in place of the nitrogen supply) ; the production of dry air for laboratory, clinical, and hospital uses ; the dehydration, during manufacture, of refrigeration components and electrical components such as valves, transistors and printed circuits ; the supply of compressed air for paint spraying, to prevent blistering during high temperature stoving processes ; the cooling of moulds in the plastics industry ; and the supply of air to pneumatically controlled equipment such as drills.

The cabinets are finished in a choice of two colours, grey hammer for factory use and cream for hospitals, etc.

An increasing use for this equipment is in the transistor field, in which the plant is used in conjunction with a form of glove box.

Cooling off...



When it comes to lowering temperatures on the grand scale—there's nothing finer than the 'Arcton' range of chlorofluorohydrocarbon refrigerants made by I.C.I.

And no wonder, for these products are manufactured to the highest standards of purity by the most modern methods. In the wide 'Arcton' range is a refrigerant ideally suitable for *your* particular use. Get in touch with us for any information you require.

'ARCTON' REFRIGERANTS

IMPERIAL CHEMICAL INDUSTRIES LIMITED, LONDON, S.W.1.

ICI

AR.34

COMMERCIAL AND INDUSTRIAL

The electric motor division of **Newman Industries Ltd.**, has opened an additional area office at 59, Grey Street, Newcastle upon Tyne, 1. Telephone Newcastle 2-3970. The new area manager is Mr. R. Martindale. A stores, adjacent to the new office, will carry stocks of electric motors and the company states that these facilities will provide a more efficient service in the north east of England.

* * *

Miller Insulation and Engineering Ltd. of Glasgow announce the appointment of Mr. George Laing to the board of directors. He will continue as technical adviser and also be in charge of the company's London office at 6–8 Upper Thames Street, E.C.4. Mr. Laing was trained as an engineering draughtsman and on completion of his apprenticeship in 1941, joined his present firm as draughtsman estimator. He was later with Fibreglass Ltd. for a few years, on marine sales and development, and subsequently rejoined Miller Insulation and Engineering as technical manager in 1954. He studied mechanical engineering at the Royal College of Science and Technology, Glasgow and is an associate member of the Institute of Mechanical Engineers, Marine Engineers, Engineers and Shipbuilders in Scotland and Institute of Refrigeration. He is the author of several papers on various aspects of thermal insulation and received the premium of the Institute of Engineers and Shipbuilders in Scotland for a paper presented in 1951.

* * *

Advantages of the space and weight-saving design of "Monobloc" pumps have been increased still further by the introduction of class "E" insulated motor windings. As a result, **Worthington-Simpson** can now offer smaller, lighter pumps in their 1½ to 10 h.p. "Monobloc" range which give the same performance as comparable units previously fitted with class "A" motors. An example from the "Monobloc" pump range with class "E" insulated motor was shown on stand No. 4, Row S at the Engineering, Marine, Welding and Nuclear Energy Exhibition. The motor is fitted to a two-stage "Vortex" pump and is rated at 5 h.p. The pump has a maximum capacity of 520 g.p.h. and a maximum head of 540 ft. depending on capacity. Dimensions and weight of this unit are :—Length 2 ft. 1 in., width 9 in., height 1 ft. 2 in., weight 175 lb. By comparison the same pump end fitted with a 5 h.p. class "A" motor has a length of 2 ft. ¾ in., is 11 in. wide, 1 ft. 2¾ in. high and weighs 216 lb. All units in the Worthington-Simpson "Monobloc" ranges will become available with class "E" motors including those units which normally have motors with totally enclosed fan cooled enclosures.

* * *

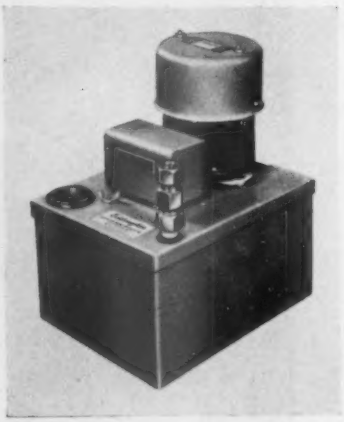
F. McNeill & Co. Ltd. of 10, Lower Grosvenor Place, London, S.W.1, are now marketing Slagbestos mineral wool in roll form as a flexible roof insulating mat. They can supply this material in rolls 16 in. wide for house insulation, and also in any width up to 36 in. for sandwich roof construction or insulation of timber, asbestos or metal panels, etc. Slagbestos insulating mat is of 1 in. nominal thickness and available in densities of 3-lb. and 5-lb. per c. ft., the "k" value being 0·24. The principal points of interest are the facts that the material is fireproof, vermin free and rot-proof together with a very competitive price which should make it of special interest to insulation contractors.

* * *

The plastics division of **Monsanto Chemicals Ltd.** have issued a technical service bulletin on polystyrene foamable beads, a product which they have newly placed on the market. These foamable beads can be readily converted into a closed-cell type expanded product by the action of hot water, steam or infrared heating. The expanded product can be produced either as lightweight granules or as compacted blocks, boards or moulded shapes. The density of the final moulding can be controlled to give the properties best suited to the end use to which the moulding is to be put and usually varies from about 1 lb. per cubic foot for thermal insulation to 5 lb. per cubic foot for special mouldings requiring strength and toughness.

* * *

Designed specifically for the removal of condensation from air-conditioning, refrigerating and dehumidifying units is a new automatic condensate disposal unit made



by **Eddington Metal Specialty Co.** of Eddington, Pa., U.S.A. The unit (C-12) is equipped with a hydro-mechanical two-level device to assure trouble-free efficiency. The tank measures 6 in. × 8 in. with height to top of motor at 10 in.

* * *

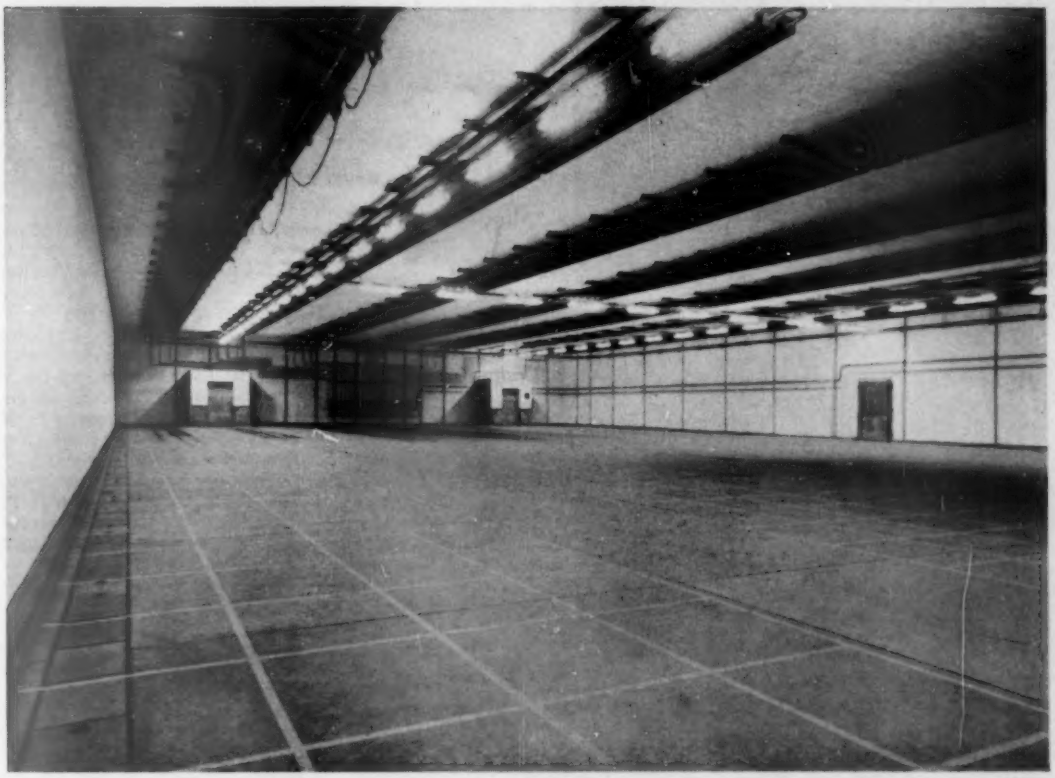
NEW SUPERMARKET

JUST recently another new supermarket was opened at Chatham by that progressive firm, Anthony Jackson's Foodfare Limited. A large crowd gathered for the opening and their expectations, when inside, were justified. Long sparkling avenues of every imaginable commodity were on display, emphasized by the lighting and harmonic surroundings with everything marked at most competitive prices.

Meat, fresh-packed fish, groceries and frozen foods all have their own refrigerated show cases, and perhaps these were the most impressive, especially the 30 ft. two-tier display case for provisions and the 30 ft. length of "Parade" meat casing, both of which were supplied by Prestcold.

THERMAL INSULATION

OF NEW COLD STORE FOR ESKIMO FOODS LIMITED AT CLEETHORPES



We are indebted to Messrs. Eskimo Foods Ltd. and the Consulting Engineers and Architects, Messrs. Jenkins, Potter, Manning & Clamp of London, W.C.1, for the opportunity of installing the insulation of this unique modern Cold Store, Pelham Road, Cleethorpes.

Manufacturers of Insulated and Refrigerated Transport · Cabinets for Plate Freezers
Super Freeze Doors and Hatches · Low Voltage Heating Equipment
Sectional Cold Rooms · "Whitsulite" (registered) Plastic Cork for Marine Insulation
Coach Building · Painting, Lettering and Designing

THE CAPACITY OF THIS STORE IS APPROXIMATELY 1,000,000 CUBIC FEET, STORING 6,000 TONS

★ We will be pleased to quote for your Cold Store be it only 500 cubic feet or smaller

Carried out by . . .

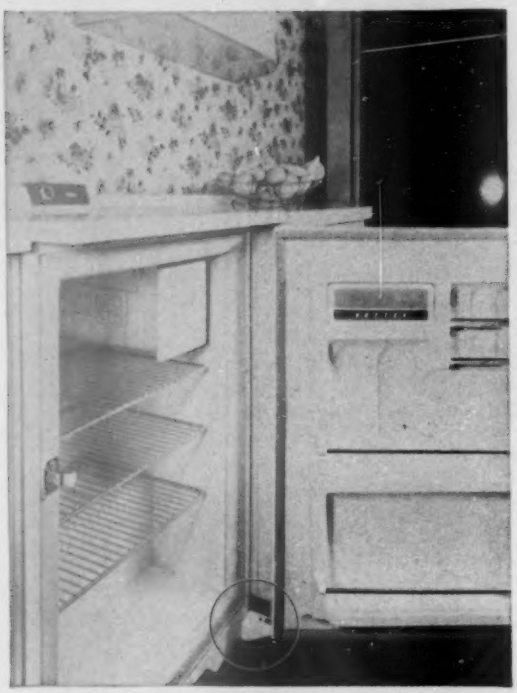
C. L. WHITAKER & COMPANY LIMITED

THERMAL INSULATION CONTRACTORS

HUMBER BANK SOUTH · FISH DOCKS · GRIMSBY Tel: **2183** Joinery Dept., Tel: **CLE 61829**

Contractors to the Admiralty, War Office, Air Ministry and Ministry of Works

COMMERCIAL AND INDUSTRIAL



"Slide-o-matic" Hinge ends Refrigerator Headache

THE annoyance of not being able to open a refrigerator door properly if the refrigerator is wedged between other kitchen furniture has been overcome. A new-type hinge, the "Slide-o-matic," patented by G.E.C., allows the door to be opened within the width of the 4 c. ft. table top refrigerator so that the cabinet can be lined up flush with adjadent built-in kitchen equipment. There is the further advantage that the door seal is effected without distortion of the gasket.

The "Slide-o-matic" feature is not adaptable to existing DE 42 cabinets and therefore a suffix letter has been added to the catalogue number of the modified cabinet, which is listed as DE 42A.

Other improvements on the "Fabulous Four" include plastic-on-steel shelves in place of tinned steel and inner door panel fixing by non-corrodible plastic rivets in place of screws.

BOOST FOR COLD DRINKS

In order to provide an extra fillip to the buoyant refrigerator market and to help stimulate public interest in Coca Cola, A.E.I.-Hotpoint Ltd. are collaborating with the Coca Cola Export Corporation Ltd. in a novel sampling promotion.

Every purchaser of a Hotpoint "Pacemaker" refrigerator which is installed during April, May or June will, on returning the guarantee application card by July 15, receive with the guarantee two vouchers, each exchangeable at any Coca Cola stockist's for six bottles of Coca Cola free.

While this promotion by Coca Cola is intended to introduce a beverage to many who may not have tried it, there is also, at the right time of year, a reminder of one of the advantages of buying a refrigerator—for chilling drinks during the warm summer months.

The offer is being covered nationally through the provincial Press, with a special free block service for dealers who wish to take advantage of this scheme.

* * *

Mr. J, W. Krall. president of **McCray Refrigerator Co., Inc. Kendallville, Indiana,** and Mr. W. Horace Partridge, managing director of Smithfield Refrigerator Co., Ltd., London, have signed an agreement licensing the latter firm to manufacture products of McCray design and granting it selling privileges in the British Isles.

* * *

Frozen Foods is obtainable from the manager, Maclaren House, 131, Great Suffolk Street, London, S.E.1, at twenty shillings per annum, post free to any part of the world.

FOOD HALL LIGHTING

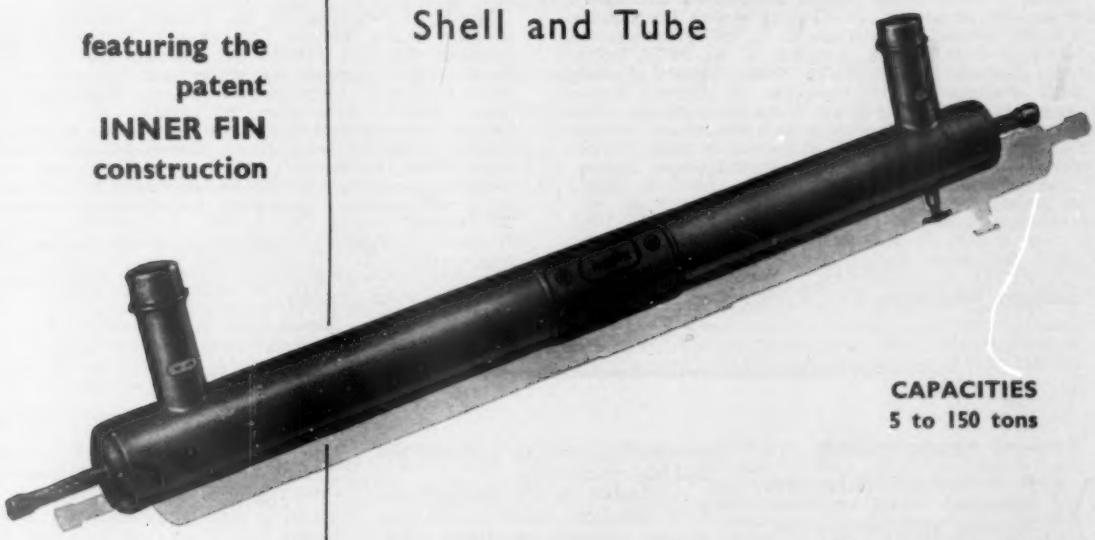
Even the most modern and hygienic equipment in to-day's food halls and supermarkets fails to achieve maximum impact on customers without good lighting. An outstanding attraction of the recently opened food hall extension (selling area 28,000 sq. ft.) of Alfred Hide & Son Ltd., Bexleyheath, Kent, is the specially designed Crompton "Modulume" ceiling suspended above the delicatessen counter. This feature matches the counter space of 48 ft. by 9 ft. and combines 30 luminous opal dishes 3 ft. by 3 ft. with 18 adjustable spotlights. The 30 Crompton high-efficiency "warm white" tubes provide about 60 foot candles of well-diffused lighting over the general area of the counter while the 150-W. spots add high-lighting to special items displayed.

heat-X

CONDENSERS

Shell and Tube

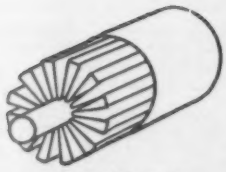
featuring the patent INNER FIN construction



CAPACITIES
5 to 150 tons

If you require heat transfer equipment of the shell and tube type that will give you maximum possible efficiency with minimum size and cost, you would do well to enquire now about Heat-X Inner Fin Shell and Tube Condensers; particularly about their exclusive patented, copper inner fin construction and the non-ferrous shell-side water passages which leave little danger of corrosion—advantages which ensure you long and trouble-free service from every Heat-X IC Condenser.

WRITE FOR BULLETIN HX/1002



INNER FIN

DUNHAM-BUSH LTD.
Fitzherbert Road
Farlington
Portsmouth Hants
Telephone: COSHAM 70161 to 4 (4 lines)

DUNHAM-BUSH

HEATING AND COOLING

Broadway/db/17

Refrigeration Patents

These new refrigerating patents have been specially selected for readers by MODERN REFRIGERATION from the Official *Journal of Patents*, and are published by permisson of the Controller of H.M. Stationery Office.

APPLICATIONS RECEIVED

March 9—Westinghouse Electric International Co., C8047, Refrigeration apparatus. 11—General Motors Corporation, C8384, Refrigerator. 12—Gibson, G. A., P8672, Refrigerators. 13—Pressed Steel Co., Ltd., Longman, C. W., P8730, Refrigerator cabinets etc. 18—CKD Praha Narodni Podnik, C9470, Absorption cooling apparatus. 20—General Motors Corporation, C9743, Ice-block release arrangement. 24—Dimentberg, M. C10147, Refrigerated underground storage. 25—Bosch, G.m.H.,R., C10263, Refrigerators doors, C10265, Refrigerators. 26—Sterne & Co., Ltd., L., and Spinney, P. M., P10560, Refrigerating system. April 6—Weyco (Equipment) Ltd., Hobson, L., P11519, Building etc. air-conditioning apparatus. 7—Brodrene Gram A/S, C11793, Ice-cream freezer. 9—Dole Refrigerating Co., Kleist, H. W., C12039, Refrigerant plates. 11—Normalair Ltd., Farthing, C. J., P12332, Air-conditioning. 14—Refrigeration & Air-Conditioning Engineering Ltd., Fowler, K. J. V., P12567, Valves. 15—Carpigiani, P., C12814, Ice cream freezers. 20—Robertson Thain Ltd., C13410, Air-conditioning systems ; Winget Ltd., Geiger, E. L., P13434, Freezing machine. 21—Bridgestone Tire Kabushiki Kaisha Yamamoto, K., C13521, Liquefied, gases refrigeration. 22—Carrier Corporation C13751, Refrigerated storage unit ; Svenska Flatifabriken, A. B., C13698, Air-conditioning method.

COMPLETE SPECIFICATIONS ACCEPTED

March 25—Munters, C. G., 813,537, Air-conditioning systems ; A.E.I. Hotpoint Ltd., formerly Hotpoint Electric Appliance Co., Ltd., 813,713, Refrigerators. April 2—Culk, R., 814,156, Compressor for refrigeration, with an electric motor horizontally flanged thereto ; Carrier Engineering Co., Ltd., 814,167, Absorption refrigeration. 8—Farbwerke Hoechst Aktiengesellschaft Vorm, Meister, Lucius & Bruning. 814,446, Refrigerant preparations ; General Motors Corporation, 814,447, Refrigerator ; Munters, C. G., 814,449, Air-conditioning systems. 15—General Electric Co., 814,808, Insulating wall structures particularly for refrigerator cabinets. 22—General Electric Co., 815,092, Refrigerating systems. 29—General Motors Corporation, 815,460, Refrigerator. May 6—Herion E., 815,593, Control valves for refrigerating apparatus ; Warwick Production Co., Ltd., 815,694, Freezing trays or tray-like containers.

NEW APPOINTMENT

MR. T. DAVIDSON has been appointed chief engineer, domestic appliance division, of The English Electric Co. Ltd. Mr. Davidson graduated with a B.Sc. degree in electrical engineering from the University of Glasgow in

Mr. T. E. Davidson, B.Sc.

1950. After four year's service in the development laboratories of the Jackson Electric Stove Co., he joined English Electric as senior design engineer responsible for the development of cookers, boiling plates and heating elements. In his new appointment, Mr. Davidson will be in charge of the company's team of engineers responsible for the design and development of a range of cookers, refrigerators, home laundry equipment, as well as heating and boiling elements.

A number of new appointments have also been made in the company's domestic appliance sales force. In the Southern Electricity Board area, **Mr. G. S. E. Wilkinson** is working from English Electric's Slough office covering the Newbury and Basingstoke district. **Mr. H. V. Young** has been promoted to senior representative at Leicester, responsible for Leicester, Warwickshire, Coventry, Derby and Burton sub-areas. Also in the East Midlands, **Mr. R. T. Adamson** operates in the Lincolnshire and Northamptonshire territory. From the Sheffield branch **Mr. D. Sanderson** covers Nottingham sub-area, Mansfield, Ilkeston and Matlock, with **Mr. G. M. Tennant** responsible to the area manager for Sheffield, Grimsby, Barnsley and Doncaster sub-areas. In the Midland Electricity Board area **Messrs. B. R. Bufton** and **R. F. Farmer** have joined the divisional staff in Birmingham.

* * *

Draught beer coolers and bottle cooling and ice-making equipment were introduced to the licensed and soft drinks trades recently by **Technicool Ltd.** of 17, Stratton Street, London, W.1. Instantaneous chilled beer is claimed by the Technicool draught beer cooler which has been specially designed for the trades at the request of a leading brewery company. The unit cools beer on the line between cask and tap and is said to drop the temperature of the beer by 20° F. in less than 60 seconds. To achieve this condition the beer has to travel an extra 34 ft. As the beer is drawn up it enters a small tank full of tiny stainless steel refrigerated plates which are fitted with deflectors to ensure that the beer zig-zags over these cold plates before it is poured into the glass. The journey over the plates extracts all the heat. This is no hit-and-miss method of cooling. The unit is thermostatically controlled, and can be used on cask or pressurized beer. There are two types of bottle coolers —WL/87 and WL/164. The former has a capacity of 87 half-pint bottles, has dimensions of 36-in. high by 48-in. wide by 9½-in. deep while the larger model has almost twice the capacity with a small increase in over-all dimensions. At the introductory reception in London, Mr. R. Schryber, managing director, said : "The days of warm beer are numbered. In fact it is true to say that acceptance of anything warm is now a thing of the past. Look around you, in the stores, in the home, in the pub. The pub you know always reflects changing public trends. It must do if it is to survive." Mr. R. S. Curry has designed the new equipment.

ROSS GROUP LIMITED

The following are salient features of the Accounts for the year ended 30th September, 1958, and of the report by the Chairman, Mr. J. Carl Ross, to the Annual General Meeting on 20th May, 1959.

"It is gratifying to report another successful year's trading by our Group. In recent years we have been planning and carrying out a programme of modernization, expansion and diversification and as a result the record profits reported last year have been eclipsed."

PROFITS

Trading Profits including income from trade investments, amounted to £678,854 (£577,028). The Group Net Profit after Taxation is £194,870 (£140,923).
After deducting the proportion of Profits attributable to Outside Shareholders £19,829 (£19,992) and adding exceptional credits as detailed £68,960 (£23,825), there is a balance available from the year's working of £244,001 (£144,756).
The Meeting confirmed the payment of the 6% Interim Dividend distributed on the then issued Ordinary Share Capital of £625,000 on 18th August, 1958 and a Final Dividend of 9% less tax, payable on the present Ordinary Share Capital of £1,000,000 as increased by the Bonus Issue of one in five and the Rights Issue at par of one in three. Subject to no unforeseen trading conditions arising a total Dividend of not less that 15%, less tax, is anticipated for the year to September, 1959.

INCREASING RANGE OF ACTIVITIES

Our Subsidiaries cover an increasing range of activities which include quick-freezing and marketing under well-known trade marks and trade names of a wide variety of frozen foodstuffs including fish, fruit, vegetables, poultry and other speciality products. In addition, wholly owned Subsidiaries are engaged in the Motor, Transport, and Engineering Industries. It is of interest to note that notwithstanding considerable additions to the Company's trawling interests since 1955, the profit, subject to tax and interest charges, resulting from fishing operations in the year to September 30th, 1958, was approximately 40% of the whole. The value of fish landed by the Company's trawlers was £3,017,713, whilst the turnover of other Trading Companies totalled £8,061,686.

ROSS FROZEN FOODS

A major policy decision has been taken recently in connection with marketing operations. Until this year, the Company's Sea Foods have been marketed under the Brand Name " SeaSparkle " and Frozen and Canned Fruits and Vegetables under the Brand Name " Westwick." " ROSS " is now to be the name under which all products will be sold, for example : " Ross " SeaSparkle Haddock, " Ross " Westwick Garden Peas. Further expansion has taken place in the Group's own products, and increased capacity is being made available in Grimsby and at Westwick to enable the Group to offer a greater volume of its high quality products to the public. Our exports have continued to expand to all parts of the world, particularly to Australia and the United States. A further substantial increase in frozen food turnover is anticipated during the coming year.

WESTWICK FROSTED PRODUCTS LIMITED

Further extensions are now taking place to increase the range and the volume of both quick-frozen and canned throughput in the factory.

JACKSTONE FROSTER LIMITED

Overseas orders completed during the past year included one from the U.S.S.R. bringing to a total of 24 the number of countries to which our " Jackstone " Froster quick freezing machines have been exported.

ACQUISITION OF YOUNGS

I am sure this will prove to be a most profitable step in the further development of our activities. Young's Potted Shrimps and Scampi are particularly well known, and a growing export trade in these lines is being developed.

FURTHER PROGRESS ANTICIPATED

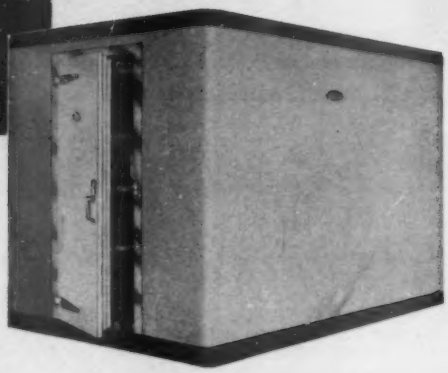
Today we are ideally placed for future and possibly remarkable expansion. Impressive progress has been made during the past five years.
Continued progress has been made since the last financial year ended.
Negotiations have been completed in regard to the purchase of certain further businesses, including Youngs, which in all will involve as consideration the issue of approximately 1,200,000 stock units of 5/- each and £20,000 in cash. Estimated annual Profits of the Companies acquired, subject to tax, are £125,000.

CURRENT TRADING

Known benefits during the current year are :—
A reduction in Profits Tax.
A reduction in Bank Interest Charges.
A more efficient Trawler Fleet
Lower Fuel Oil Costs.
These have contributed to the improved trading experienced to date.

Copies of the Annual Report are available from the Secretary,
1 HUTTON ROAD, GRIMSBY

REFRIGERATION *at its best!*



Whatever you pay for your refrigeration plant, it is so much money wasted unless it is absolutely reliable at all times.

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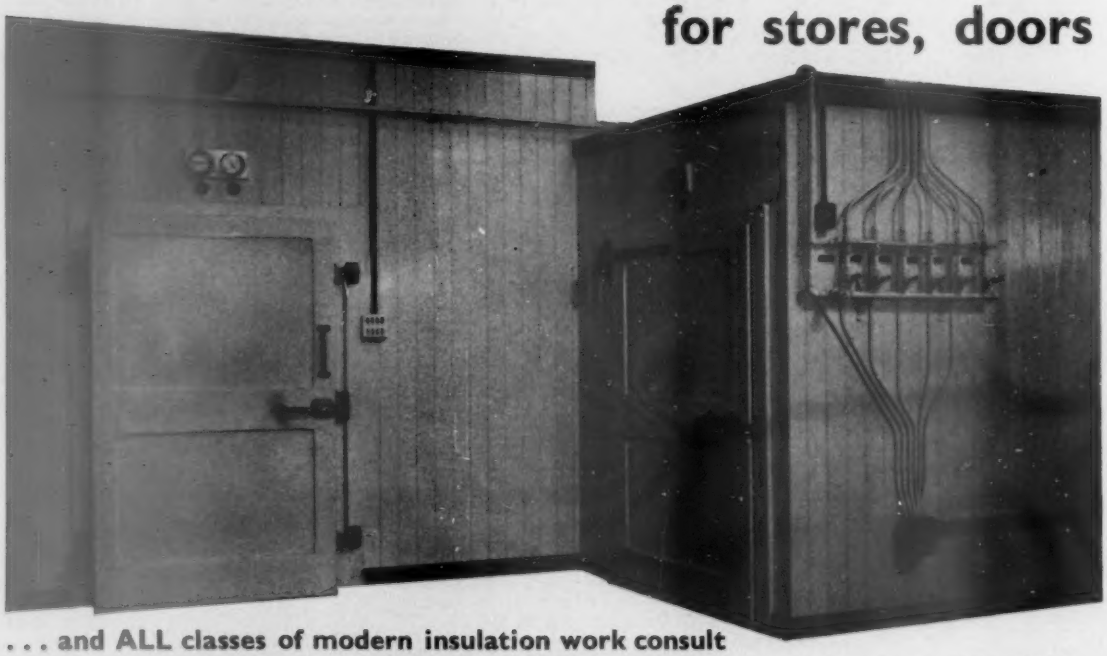

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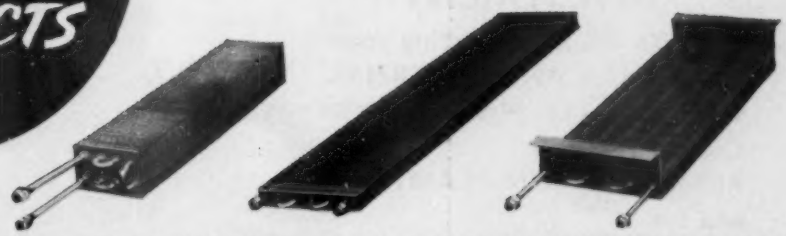

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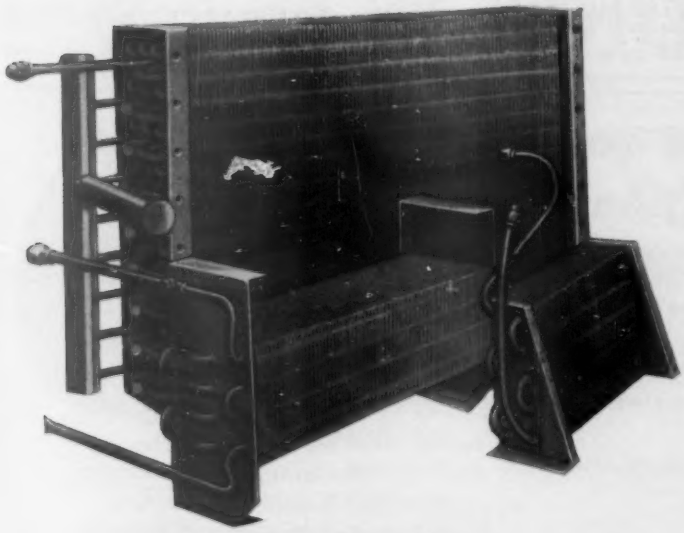

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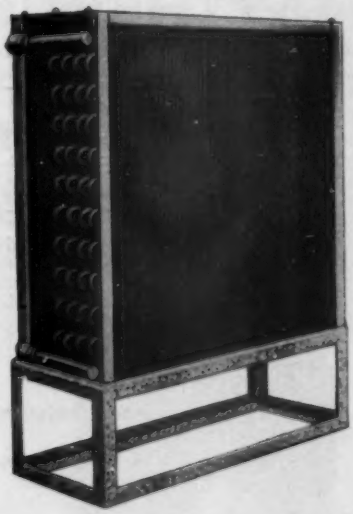

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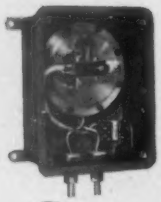

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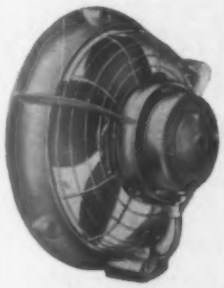

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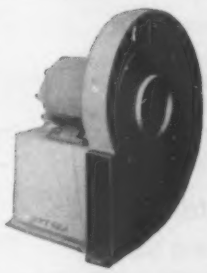

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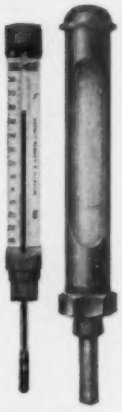

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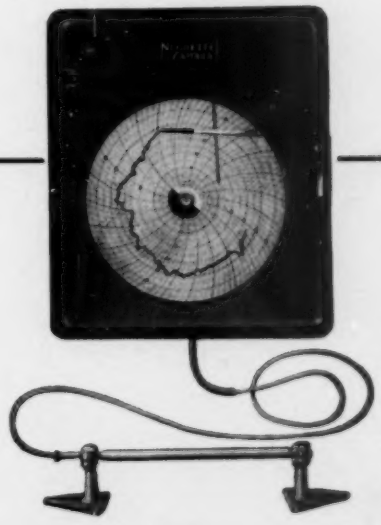

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